NOVEMBER 1960 / 60c

AIR FORCE

and SPACE DIGEST

The Magazine of Aerospace Power / Published by the Air Force Association

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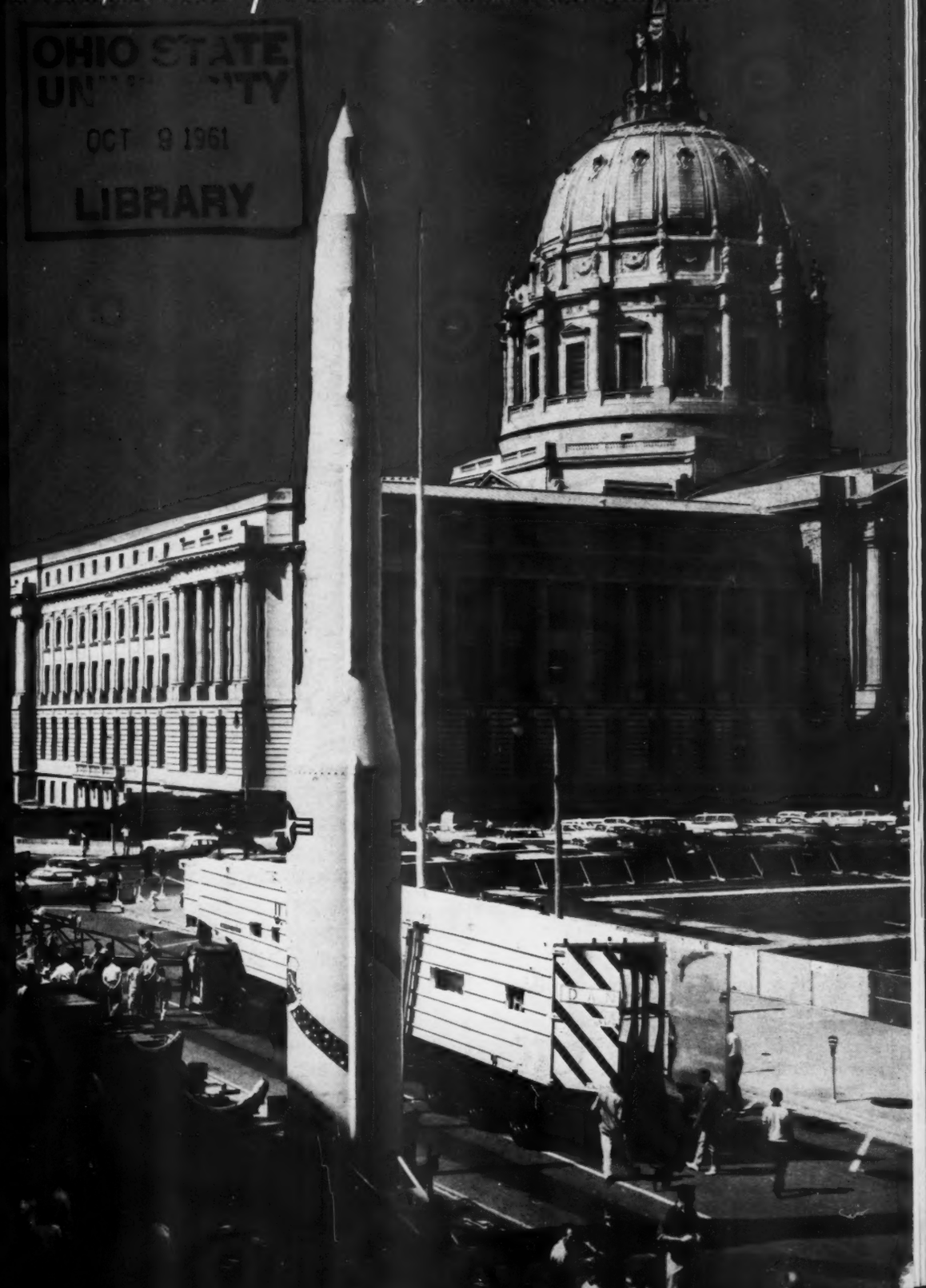
The Central Theme of Air Force Association's 14th Annual Convention San Francisco September 21-25



around the world in 100 minutes

...a problem in navigation and guidance

Behind that storied global traveler Phileas Fogg was his valet and navigator Passepartout. Tomorrow's space "Phileas Foggs" will depend on a sophisticated electronic Passepartout to guide their vehicles to the fringe of space and return — in 100 minutes.

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Arma is developing smaller and better inertial systems for use in the years ahead that employ subminiature computers, low threshold accelerometers, gyros suspended in liquid metal and other advanced techniques in inertial instrumentation.

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7910 REV

Engineers: Write to E. C. Lester at ARMA about career R & D opportunities.

AMERICAN BOSCH ARMA CORPORATION

WHATEVER THE WEATHER

the Ryan AN/APN-97 Doppler Navigator for helicopters continuously and automatically detects and displays drift, vertical and heading speeds. By providing sustained automatic hovering and **all-weather** capabilities, it made possible a vital breakthrough in anti-submarine warfare missions. The first, lightest, self-contained navigator of its kind, the APN-97 is in full production for the Navy, Marines and Coast Guard and is the **only** Doppler helicopter navigator in world-wide operational use. The APN-97 operates on the **approved** frequency of 13,300 megacycles and has demonstrated **very high accuracy.** Applications include: All-Weather ASW, Rescue, Navigation, Blind Landings, Automatic Hovering, Aerial Surveys, Drone Helicopter Control, Traffic Control. World leader in the field of C-W Doppler navigation, Ryan Electronics is also making significant progress in solving problems essential to the success of future missions into Space.

RYAN

ELECTRONICS

A DIVISION OF RYAN AERONAUTICAL COMPANY ■ SAN DIEGO ■ CALIFORNIA

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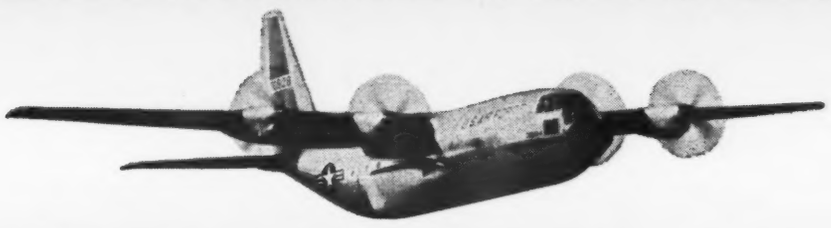
The Lockheed/Georgia C-130 Hercules has served with TAC for more than 3 years—and has proved it meets all requirements for true airlift operation: straight-in end loading; truck-bed height cargo floor; air-conditioned pressurized cargo compartment; and ability to lift, land, or airdrop heavy, bulky pieces of freight. And the C-130 can get closer to the action—operating to and from strips much too rough and short for most cargo airplanes.

Lockheed Georgia Division, Marietta, Georgia.



LOCKHEED GEORGIA

WORLD HEADQUARTERS FOR AIRLIFTERS AND CARGOLOADERS

Air Force's T-39 Sabreliner exceeds design specifications

The T-39 Sabreliner, Air Force's first twin-jet utility trainer, bettered its design speed and range by handsome margins in a non-stop test flight over the Western United States. Designed to cruise at 500 mph over a range of 1720 miles, the swept-wing T-39 averaged 540 mph during an 1820-mile flight. Then it loitered for an additional half hour and landed with ample fuel reserves.

The Air Force has ordered 94 of the multi-purpose aircraft for use as radar, navigation, and jet-proficiency trainers—as well as high-priority cargo transports. The T-39 is an aircraft of exceptional all-round utility and economy—a compact workhorse designed especially for jet-age needs. It is being produced by the Los Angeles Division of North American Aviation.

THE LOS ANGELES DIVISION OF NORTH AMERICAN AVIATION, INC.

AIR FORCE

and **SPACE DIGEST**

The Magazine of Aerospace Power / *Published by the Air Force Association*

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AFA STATEMENT OF POLICY—1960

THE WAR THAT MUST

HISTORICALLY, the United States has risen to its full stature only in times of grave emergency.

Such an emergency exists today.

We are at war—a war of many fronts.

On the economic front the war is just beginning.

On the military front we are still sparring.

On the ideological and technological fronts we are in all-out conflict.

It still remains for the nation to recognize these facts and rise to meet the challenge to its freedoms.

The Fallacy of Minimum Deterrence

Basic to the very survival of the free world is a military posture *second to none* in the decisive weapons of modern war—specifically the weapons of aerospace power.

Today a fallacious and dangerous strategic concept of so-called "minimum deterrence" is undermining the nation's defense effort. This concept is based on the misguided belief that it is possible to deter war with forces that are not strong enough to win a war should it come.

The minimum-deterrence theory holds that the threat of destruction of Communist cities and their populations is enough to deter aggressive military activities of the Soviet bloc. It further holds that the ability to destroy the enemy's military forces is therefore unnecessary. War will not happen, it says; therefore it is not necessary to prepare to win it.

The minimum-deterrence theory has attracted powerful and vocal adherents. Its appeal is primarily to two groups:

- Those who wish to hold defense budgets to a minimum level;
- Those who, for self-serving reasons, wish to see the nation's strategy tailored to the capabilities of certain weapon systems, rather than weapons tailored to strategy.

The Air Force Association takes sharp issue with the minimum-deterrence concept. The Association believes that true deterrence can be achieved only with forces designed to fight and win against the forces of the enemy—a counterforce posture. We condemn the concept of minimum, counterpopulation deterrence as false, pernicious, immoral, and, in the long run, suicidal for the free world.

Unification

The current conflict over defense doctrine is a pertinent example of the divisive influences which continue to rack our present military structure. The nation still lacks a single cohesive war plan. It lacks the organization and proper blend of forces needed to carry out the difficult task of deterring war over an indefinite period of time.

The Air Force Association, therefore, strongly reiterates its long-held position on defense organization.

We believe, more than ever, that full utilization of the nation's military power can come about only through complete and unequivocal unification of the present multiservice, multiplan, multigoal defense structure.

We believe, more than ever, that the nation must have one war plan.

We believe, more than ever, in the need for a single military service, with one secretariat, one chief of staff, one promotion list.

We believe, more than ever, in a military structure functionally oriented to the major tasks of offense, defense, and logistics support. Only within such a framework can military careers, and military operational concepts be divorced from adherence to obsolescent weapons and outmoded or inadequate doctrines.

Immediate action to unify the services should be the primary defense goal of the incoming Administration, whichever political party is victorious in the forthcoming presidential election.

The Shrinking Deterrent Margin

But reorganization is not enough. The shrinking margin of our deterrent posture, already thin enough to encourage Soviet ventures into nuclear rocket blackmail, must be widened with all speed and at all costs.

The strategic delivery forces of the nation, concentrated almost entirely in the Air Force's Strategic Air Command, must be provided with the blend of weapons and the protective measures that will ensure the ability to survive a surprise attack and still deal a decisive blow to the Communist forces. SAC must be modernized, dispersed, and hardened, with a substantial portion made mobile on the ground and in the air. Intercontinental ballistic missile production and deploy

BE WON

Following is the 1960 Statement of Policy of the Air Force Association, as adopted unanimously by the delegates to AFA's National Convention, San Francisco, California, September 22, 1960

ment must be accelerated. The B-70 Mach 3 bomber program must be removed from its present "lip-service" position and given stature as a full-fledged weapon system. The number of aircraft maintained on airborne alert must be raised to a meaningful level—at least double the present programed rate.

The defensive arm of the nation's general-war deterrent force—the active air defense system—must also be strengthened and modernized. The United States today is highly vulnerable to surprise attack from both Soviet missiles and manned bombers. There is no advanced interceptor in the program, and the pursuit of a defense against ballistic missiles displays a singular lack of imagination, determination, and tenacity. Both shortcomings must be rectified with utmost dispatch, as integral parts of United States deterrent strength, to enhance the survivability of the strategic forces.

To cope with situations short of general war, the tactical forces of the free world—land, sea, and air—must be made more mobile and flexible.

The global airlift capability of the Military Air Transport Service must be strengthened through accelerated modernization of its transport fleet.

The important area of passive defense is almost entirely neglected. The nation must move to protect its own people, military and civilian, against fallout and other radiation hazards. It must provide for continuity of government at local, state, and national levels. And it must look to assurance of national economic recovery following a general war. In this general area of postwar recovery the reserve forces have the ability to make a contribution far beyond that now required of them.

The Space Mission

None of these measures, however, can be more than a temporary tranquilizer until the nation raises its eyes from its immediate problems and bends its will and its resources toward the purposeful conquest of space.

The military mission in space must be recognized, identified, and exploited with overriding priorities and singleness of direction and purpose. Our deterrent posture in the future lies in military space systems, both manned and unmanned, offering positive warning of surprise attack and positive and swift action against the attacker. Bold exploitation of the space medium for avowedly military purposes can paradoxically be the shortest road to a controlled peace.

What We Must Do

The nation is lagging behind the Soviet Union in many fields. It should be obvious that all cannot be done if the current lethargic pace is followed. Across the world lies a determined adversary, an adversary who is as tough, as energetic, as dynamic as were the American people 150 years ago.

The Air Force Association fervently believes that the American people still possess the qualities bequeathed us by our forefathers—national and individual attributes of courage, intelligence, and integrity, which—if teamed with work and sacrifice—can pull us from the brink of disaster.

The cold war is a continuing conflict on many fronts —military, political, economic, technological, cultural, spiritual, and psychological. Our survival in this protracted conflict requires full recognition of information as a modern weapon; it requires an integrated national plan to utilize *all* our resources in the battle for men's minds.

All America must "mobilize" on these terms:

- We must exert every effort to conserve our resources and to exploit them in the national interest.
- We must achieve full utilization of our military power through a unified military establishment.
- We must produce more, work harder, and, when necessary, sacrifice to maintain our military strength—primarily our aerospace power.
- We must base our military requirements on what is needed.
- We must build our technology to a position of leadership in every essential field.
- We must create and accelerate a national plan to integrate all of our resources in the battle for men's minds.
- We must look within ourselves and our institutions and tighten our morality so as to warrant the position of free-world leadership in which we, as a nation, find ourselves.
- We must so conduct ourselves as to be worthy of the great blessings of freedom which we now enjoy.

There is no alternative but decay and ruin.—END

Monsanto **Space-Age Project "NEW MOLECULES"**

CHEMICAL EXPEDITIONS BY

Monsanto's Special Projects Department... mapping pathways to unique molecules that solve difficult military and industrial problems

Engineers in the rapidly expanding aerodynamic, electronic and mechanical sciences are hampered by having to accommodate their needs to conventional compounds that are "on hand." Monsanto recognized this problem as vital to defense and to industry, and three years ago established the Special Projects Department, a research facility largely devoted to study of scientific problems facing our government. This aptly named department is making significant advances toward solving a number of today's critical material needs.

Monsanto's Special Projects Department conducts research and development programs to produce special new materials to fit specific requirements. This laboratory focuses the scientific resources of a major chemical company on creating special molecules. Here, basic science and applied technology in organic, inorganic, polymer and petroleum chemistry are integrated in the creative expedition.

Available to the government and its prime contractors for contract research, the Monsanto Special Projects Department provides the maximum probability of ultimate success in developing chemical materials for space-age technology because the "know how" and research effort are concentrated in one well-rounded organization. It is currently at work in a number of vital areas of technology:

SOLID PROPELLANTS...

for the Bureau of Naval Weapons, exploring complete new types of solid propellants. As a creator, developer and producer of commercial chemicals, Monsanto's studies are directed at altogether new chemical systems of energy release for solid core rockets.

HULL-VIBRATION DAMPING...

for the Navy, Bureau of Ships, developing plastic coatings to damp vibration of metal parts. Study has developed a mathematical formula that relates actual engineering damping to fundamental constants of the polymers. Developed to date: a series of compounds that promise to be twice as effective as any previously known.

HIGH-HEAT-STABLE FLUORINE COMPOUNDS...

showing the most promise for use as high-temperature lubricants and fluids for the Air Force. By critical screening, Monsanto research has determined that perfluorobenzene appears to be a highly heat-stable building block. By screening various types of compounds, this order of heat stability was disclosed: certain compounds with fluorine and carbon only—stability greater than 1000°F.; special aromatics—up to 1000°F.; nitrogen heterocyclics—up to 950°F.; silicon compounds—to 900°F.; phosphorus compounds—to 850°F. Several major fields of fluorine chemistry have been "blocked out" and the research begun for heat-stable fluids and lubricants.

CONTROLLED-PERMEABILITY FILMS...

research for the Office of Saline Water on plastic sheeting that can rapidly pass water but retain the ions of dissolved salts. These films would have a controlled permeability based upon their molecular structure—in effect, hold promise for separating a variety of salts from solution and specifically for purifying sea water.

INORGANIC POLYMERS...

for the Air Force—investigating the bond strength of linkages between various combinations of nonmetals to find "plastics" composed of molecules with phosphorus-to-carbon-to-sulfur bonds; macromolecules with ionic bonding; nitrilic chlorides; cyano-fluorocarbons; and several types of metal-phosphorus-carbon linear polymers.

HEAT-RESISTANT ADHESIVES...

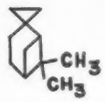
for the Air Force—polymers to develop high bond strengths between dissimilar materials at elevated temperatures. One series of polymers may yield metal-to-metal bonding that holds firm at 500-700°F., might be used to glue ovens together —and in many plants to eliminate welding.

HIGH-TEMPERATURE LAMINATING RESINS...

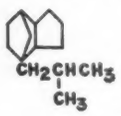
for the Air Force—studies proceeding with a new series of resins that apply as easily as water to blotting paper, that catalytically cure at room temperature, and withstand exposure to temperatures of 500-700°F.

HYDROCARBON FUEL SYNTHESIS AND EVALUATION . . .

screening compounds for improved jet fuels. Under Air Force contract, some exotic and highly interesting fuel candidates have been prepared, including compounds with spirane linking, steric crowding, and cyclopropyl groupings. Some unusual candidate compounds never before prepared include:

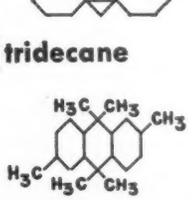


5,5-dimethyl-4,6-methanospiro [2.5] octane



1-isobutyltricyclo [5.2.1.0^{2,6}] decane

dispiro [5.0.5.1] tridecane



2,2,5,9,9,12-hexamethyltricyclo-[8.4.0.0^{3,8}] tetradecane

HIGH-TEMPERATURE LUBRICANT ADDITIVES . . .

for the Air Force—to provide extreme-pressure properties, pour-point modification, viscosity-index improvement, and oxidation resistance to synthetic lubricants that must operate in the temperature range of 600-800°F.

This simple apparatus was developed by Monsanto in collaboration with the WADD Materials Laboratory. In this simple refined form, it is essentially a modified Bodenstein gauge and is used to measure accurately the thermal stability of as little as 0.2 gram of liquid or solid up to above 1000° F.

In addition to the foregoing, Monsanto scientists are studying the chemistry of semiconductors, micro-metallic oxides, electroluminescents, fuel cells, molecular separation of helium, intra-metal thermocouples, radiation-resistant coolants and heat-transfer fluids.

SPECIAL MATERIALS FOR SPACE-AGE ENGINEERING...a chemical capability of Monsanto

Supersonic vehicles, guidance systems, satellites, data-transmission systems, solar batteries, early-warning networks—their rapid evolution has overrun the performance of existing materials. New materials—of many kinds—are urgently needed. These new materials start from new molecules, and Monsanto research chemists, whose professional *raison d'être* is creating new molecules, can help other scientists whose major interests are the finished items—not the stuff of which they are made or the numerous and complex "goops" essential for space-age hardware operation.

Monsanto's knowledge of synthesis of materials is a valuable adjunct available to specialists in many fields of advanced engineering. When your project requires a material with special properties, you are invited to discuss your needs with Monsanto. Write or call: MONSANTO CHEMICAL COMPANY, Department 02-A, C Building, St. Louis 66, Missouri.

For further details on Monsanto's capabilities in the field of special materials development, request a copy of bulletin RE-1: PEOPLE AND PROJECTS.

Monsanto

AIRMAIL

Ready Reference

Gentlemen: Your September 1960 AIR FORCE Almanac issue is an outstanding example of another vital contribution by the Air Force Association to over-all public understanding of the Air Force and its many aerospace missions.

Your entire staff is to be congratulated for a superb job of editing and publishing.

As the almanac of Air Force activities, I will certainly have it at hand for ready reference throughout the coming year.

Many thanks and congratulations for such a splendid effort.

Gen. Thomas D. White
Chief of Staff, USAF
Washington, D. C.

Gentlemen: Please accept my personal congratulations on your 1960 Almanac edition of AIR FORCE/SPACE DIGEST. It is an almanac in the truest sense of the word and has already proved useful here at the United States Air Force Academy.

Your excellent handling of the Academy story has caused favorable comment by all those who have had an opportunity to see it. I sincerely appreciate the job you have done in our behalf.

You will be pleased to know that each of the first- and second-class members have received a personal copy and the Cadet Squadron day rooms have a supply. I am sure this issue will become a popular addition to the Cadets' reference file on the Air Force.

Maj. Gen. W. S. Stone,
Superintendent
United States Air Force Academy
Colo.

Gentlemen: Congratulations on the excellent September AIR FORCE/SPACE DIGEST.

I hope all officers, airmen, and civilians have an opportunity to read it. . . . I realize, after reading it, that I owe you plenty, because knowledge gained throughout the past years has paid off in many ways.

MSgt. Henry J. Lacour
Tyndall AFB, Fla.

Department of Correction

Gentlemen: Your Almanac issue was up to its usual very fine standard again this year. However, I did notice one rather glaring error in the Command Chart on page 213. The photograph above the caption "Director of Operations, Maj. Gen. Sam W. Agee" happens to be that of Gen. Sam Agee's brother, retired Air Force Maj. Gen. Walter R. Agee. Since graduating from the US Military Academy in '37, "General Sam" served in many branches of the Air Force before assuming duty as Director of Operations, DCS/Operations, at Headquarters USAF, in Washington, D. C.

Maj. Gen. Sam W. Agee

Dick Nesline
Richmond, Va.

● *Thanks for a good catch. Here is a photo of the real "General Sam."*—THE EDITORS

Gentlemen: Again the September issue of AIR FORCE Magazine's Almanac admirably covers the worldwide activities of the Air Force. However, in editing General Smith's contribution about the United States Air Forces in Europe, you inserted information to the effect that USAFE Headquarters still has ADVON and REAR elements.

The fact is that, when Seventeenth Air Force was moved from Wheelus to Ramstein in October of last year, USAFE consolidated its entire headquarters at Wiesbaden. The majority of USAFE's combat forces committed to NATO now are divided between Third and Seventeenth Air Forces. To have a factual article on USAFE, readers should line out the two references to ADVON on page 126 and the single reference on page 214.

Otherwise, your magazine is excellent as always.

Col. George A. Carter
Hq. USAFE
APO, N. Y.

Gentlemen: As far as we know, Cape Canaveral is still north of Patrick Air Force Base, Fla. (approximately fifteen miles). Therefore, we feel that you, no doubt, would like to correct an error in the AIR FORCE Magazine Map (as of August 15, 1960) captioned "Major Active Air Force Bases in the United States," on page 225 of AIR FORCE/SPACE DIGEST, September 1960 issue, wherein Patrick AFB is shown as north of Cape Canaveral.

Maj. Roland W. Sellis
Patrick Air Force Base, Fla.

● *You are right, of course. And we'll see that it's corrected next time the map is printed.*—THE EDITORS

Gentlemen: I noticed in your September issue at least two mentions of my good friend, who was former commander at Craig Air Force Base, Ala., Brig. Gen. Leo F. Dusard, Jr., now at ATC.

I refer to pages 81 and 98, but in each case he was named as Lee; it, of course, should have been Leo. I feel that this is not a typographical error, rather do I believe your records might be in error.

Arthur J. Lewis
Selma, Ala.

● *We obtained the information as to General Dusard's name by long distance telephone and apparently misheard it. We have corrected our records—and thanks.*—THE EDITORS

Q-2C Firebee

Gentlemen: . . . Ryan finds your 1960 September Almanac edition of AIR FORCE/SPACE DIGEST very complete and keeps it readily available for reference.

However, I was very surprised to note the Q-2 version of the Ryan Firebee present in the Gallery of USAF Weapons section. The Q-2 has undergone considerable modification.

(Continued on following page)

MATERIALS

Another area
of advanced inquiry at U. T. C.

A unique study of high temperature materials as related to rocket engines and engine systems is being carried through by a staff with unusual capabilities at United Technology Corporation's new multi-million-dollar research and development complex in the San Francisco Bay Area.

Specifics under investigation include:

- Thermal and mechanical properties of refractory oxides, carbides, borides, and nitrides, including nonstoichiometric mixtures and intermetallics
- Composite systems including fiberglas plastics, metallic plastics, and impregnated ceramics
- Behavior of ablating substances under high heat flux, including plastics, ceramics and their composites

Advanced concepts of major significance are resulting from this research.

UNITED TECHNOLOGY CORPORATION

A subsidiary of United Aircraft Corporation

P. O. Box 358 • Sunnyvale, Calif.

The Q-2C Firebee—now in service—can be either ground-launched or air-launched from a mother plane. Ground launching of Ryan jet targets has been conducted at Holloman Air Force Base, N. M. The Q-2C is the growth version of the Q-2A and KDA Firebee series.

The Ryan Q-2C has a parachute-recovery system and is powered by a J69 turbojet engine with a rated thrust of 1,700 pounds SLS. The power unit is manufactured by Continental Aviation and Engineering Corporation. The target missile will cruise at over 600 mph at 50,000 feet. Maximum ceiling is 59,800 feet. The Q-2C has a span of 12.9 feet, length of 22.9 feet, and height of 6.7 feet. Basic gross weight is 2,060 pounds. Endurance is ninety-six minutes.

The Q-2C enables missiles to be evaluated through provisions for simulations of various types of aircraft. These augmenting features are provided by radar beacons, traveling wave tube amplifiers and infrared flares. Also, countermeasures equipment may be installed.

Dick Stauss
Public Relations
Ryan Aeronautical Company
San Diego, Calif.

Other Side of the Coin

Gentlemen: I think your magazine supplies the Russians inadvertently with too much information—even if you think they have it already. Why assume this? You don't see Tass or any Soviet paper providing us with similar information.

John E. Tynan
New York, N. Y.

Gentlemen: AIR FORCE Almanac 1960 (September 1960). What a foreign intelligence agent's delight!

Brig. Gen. John M. Schweizer, Jr.
USAF (Ret.)
Paris, France

• *These opinions as to our Almanac issue being a foreign agent's delight are, unfortunately, not uncommon ones. We can only say that the material was compiled from completely unclassified sources and that, in a free society, dissemination of such information to the public serves a purpose far more useful than the possible advantages accruing to our potential enemies. In support of this we can do no better than to refer to the first letter in this department from Gen. Thomas D. White, Chief of Staff, USAF.*—THE EDITORS

Squadron Insignia

Gentlemen: I am compiling data on US Air Force fighter squadron markings and squadron insignia and would like to know if you could help me with back issues of AIR FORCE Magazine which I think may be a good source of reference.

The markings of interest to me are of the complete postwar period—1945 to date—all types of fighter and fighter bombers.

I would also be very interested in information on the wing squadron and scout force markings of P-38s, P-47s, and P-51s based in England and Europe 1943-45.

Information from any individuals interested in the above subject would be appreciated.

R. Ward
11, Cliffe Rd.
Gonerby Hall Foot,
Grantham, Lincs, England

Air Transport Story

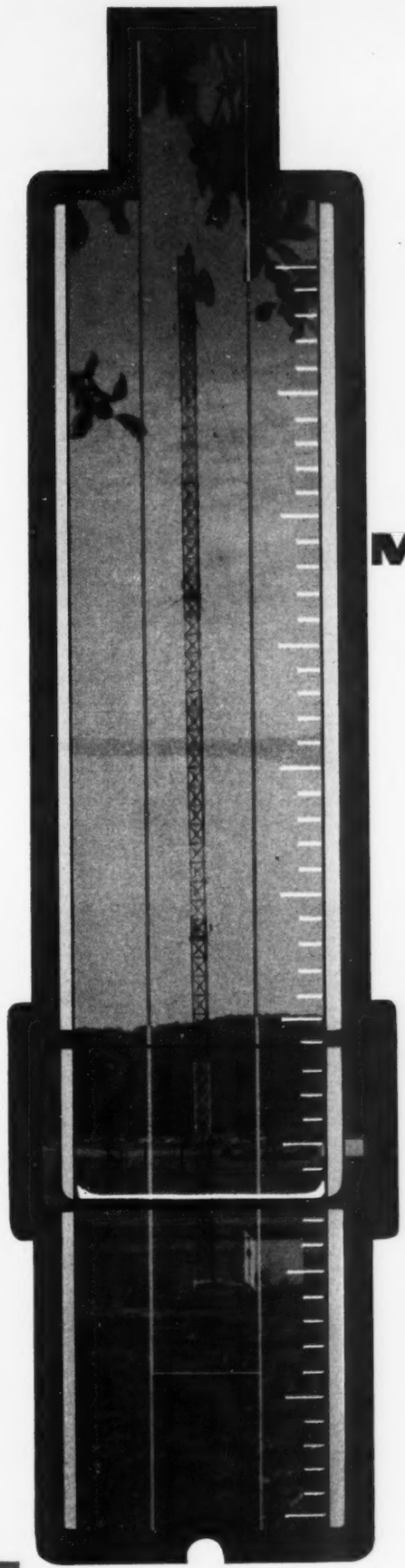
Gentlemen: . . . I am convinced that air transport is not properly understood and those engaged in it fail to sell their products to the best advantage. In a manner of speaking they plank down naked advertising stating that cargo can be carried at a certain rate between two points and they leave it at that. If they would only tell the story of how vast economies can be made by using air transport in cutting down stocks and saving time in transit, I believe they would reach the heart of many manufacturers and industrialists who today only count the cost of air cargo by comparison with rates charged by railways and road transport.

I think the manufacturers of big aircraft should study this problem which is really one of educating the laymen in the uses of aviation. Unfortunately, magazines such as yours and mine do not appeal to the average business executives, few of whom even see aviation magazines. Perhaps in your country these things are better understood.

R. Vaughan-Fowler, Editor
Indian Skyways
Bombay, India

UNIT REUNIONS

38th Bomb Wing—Nov. 4, 5, 6, 1960
Former "Blackbirds" of Laon Air Base, France, at the Safari Motel, Scottsdale, Ariz.
Contact: Maj. W. W. McDaniel
3653 Zuni St.
Glendale, Ariz.
Phone: WE 5-3403



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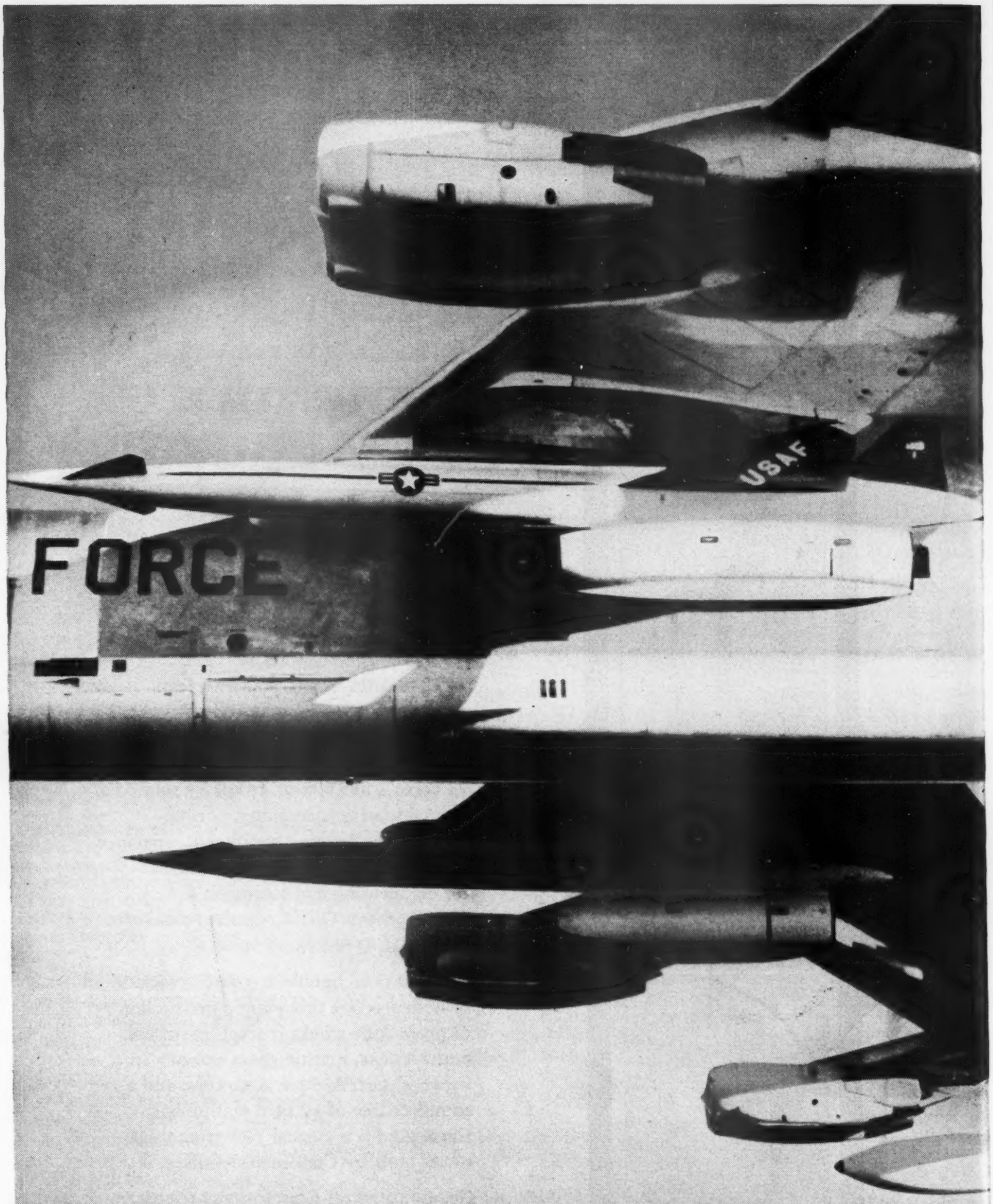

POWER TO FLY...POWER TO PROTECT... by Pratt & Whitney Aircraft. Today the Strategic Air Command's Boeing B-52 bomber has a new profile. Inboard from its J-57 turbojets, two more Pratt & Whitney Aircraft jet engines have been added...a pair of J-52s. These engines power the North American Hound Dog guided missile, designed to deliver a nuclear warhead behind enemy lines at supersonic speed. And for faster take-off, the power of the twin Hound Dogs augments the thrust of the B-52's eight J-57s. Aloft, both the bomber and its Hound Dogs can be refueled from aerial tankers. The application of the J-52 jet engine to the Hound Dog missile is another example of Pratt & Whitney Aircraft's expanded activities in new fields of power.

Pratt & Whitney Aircraft East Hartford, Connecticut / A Divison of United Aircraft Corporation

What's New With ★ RED AIRPOWER

Here's a summary of the latest available information on Soviet air intelligence. Because of the nature of this material, we are not able to disclose our sources, nor document the information beyond assurance that the sources are trustworthy.

No new aircraft were displayed by the Russians on Soviet Aviation Day in August. Soviet Chief Air Marshal Konstantin Vershinin, in a speech that day, said the Red Air Force is being reduced in size as part of the general cutback of Soviet armed forces. Mentioning no figures, he went on to say that the cutbacks were being compensated for by "the improved quality of the aircraft and their equipment." Vershinin boasted that most Soviet planes were superior, type for type, to those of the NATO countries.

The Air Chief Marshal said rocket forces are now the primary military force in the USSR.

A few days later, on Soviet Navy Day, Admiral Sergei Gorshkov, Deputy Minister of Defense and Commander in Chief of the Soviet Navy, made a similar declaration. "Rocket troops, which have the greatest firepower, now form the chief branch of our armed forces," he said.

He also said large fighting ships, including aircraft carriers, represent the yesterdays of navies. A submarine navy is the core of a modern navy, he declared.

° ° °

The USSR will have a supersonic air transport in the air as soon as the US, says the Deputy Chief of Aeroflot, Lt. Gen. Georgi Schetchikov. He did not go into details. The plane was expected to appear sometime in the next three or four years. Most likely it will be under Mach 2, to judge from the capability of Soviet power plants.

° ° °

A study of open Soviet technical literature indicates the Russians have done very little work on ion and plasma jet engines for propulsion and power in outer space.

° ° °

India has decided to purchase Soviet helicopters for doing patrol work along its northern frontiers, where the Chinese Reds have been giving trouble. The Indians say the Russian machine is simpler and costs less than a comparable American type. Price of the Red copter was $150,000, of a similar US chopper, $260,000.

° ° °

Russian statistics, which always indicate a tremendous rate of Soviet economic development, have been taken over the high hurdles by the dean of Soviet economists, S. G. Strumilin. He says the present methods of statistical counting often lead to progress being counted twice. For example, the value of airplane engines may be counted when they leave the engine factory, and then counted again as a part of the value of the airplane when it is delivered. Because more and more complex equipment is being produced in Russia every year, the tendency has been, because of double and triple counting, further to inflate the rate of progress.

At the same time, even the downgraded rate of Russian progress suggested by Prof. Strumilin is impressive. Before Strumilin began to criticize, the Bureau of Statistics in Moscow indicated the rate of growth was eleven percent in 1955 and 1956. Strumilin says it has been only eight percent.

° ° °

More than half of Aeroflot's flights are turbine powered, according to Y. Loginov, Director of the Chief Civil Air Fleet Administration. "Gas turbine aircraft are now used on almost 100 of Aeroflot's domestic and international air routes," he declares. Apparently, as a result of the increase in the availability of aircraft, Aeroflot transported more passengers in the first six months of 1960 than it did in the entire year 1958.

° ° °

Moscow's busiest airport, Vnukovo, handled 175 flights per day in 1957, latest year for which figures are available. Idlewild Airport handled more than 430 flights per day that same year. Chances are, however, Vnukovo has come a long way since, in view of Soviet stress on aviation prestige.

° ° °

Two television cameras were aboard the space capsule in which the Russians sent up two dogs and brought them back late this summer. The Soviets had great success in getting TV pictures from the space capsule, according to their own accounts. One camera was focused on instruments in the space vehicle. This pictorial information, plus that from telemetering equipment, was transmitted to the ground and used by operators there in deciding what adjustments should be made to control the flight of the space vehicle. Adjustments were passed along to the capsule by command radio.

This was the space capsule that was said to have come down within about six miles from the point at which it was scheduled to land.

° ° °

Sure-fire evidence that they have been hard at work on man-in-space programs was demonstrated by the Russians at the International Astronautical Congress in Stockholm in August. The Reds showed a film entitled "Passport to Space" which included weightlessness and centrifuge experiments with people. The centrifuge took one astronaut up to seven Gs for one and a quarter minutes. The work probably is being done at Leningrad.

° ° °

At least seven of those Soviet intelligence trawlers in the North Atlantic are studying the Gulf Stream, according to Radio Moscow. Among other things, they are examining the effect of the Gulf Stream on the climate of northern countries. The Hydrographic Service of the Soviet Navy is taking part in the work and has assigned sailors and technical personnel to the vessels.

° ° °

It has been long accepted that the Russians have an intermediate-range missile that could be launched from underwater. So they say, and there has been no apparent reason to doubt them. Now comes the testimony of a Soviet destroyer commander to the effect that the USSR has now at least one atomic-powered submarine, a point which we did not think they had reached. The Russian was Red Commander Nikolai Artamonov, Soviet defector. He presented his testimony to the House Un-American Activities Committee.

The Russians have had an atomic icebreaker for some time.—END

AIRPOWER in the news

Claude Witze
SENIOR EDITOR

Photo courtesy British Information Service.

Probably the most spectacular formation flying staged at any air show is this Farnborough highlight. The planes, eighteen of them, are Hawker Hunter F.Mk.6 fighters of the Black Arrow Squadron, No. 111, of the Royal Air Force.

Photo courtesy British Information Service.

In the static exhibit area, around the arrow on the runway, are the Vanguard turboprop airliner, the Dart Herald turboprop, the Argosy freighter-coach, the new Avro 748 feeder liner, and the Victor bomber. Missiles in distance.

How to Grow Up

LONDON

There has been a good deal of pessimistic comment about the sad state of British aeronautical progress, the most caustic of it from Americans, as a result of this year's Farnborough Display of the Society of British Aircraft Constructors. The reaction is based, in most cases, on the fact that there were few new airplanes shown, in contrast to some of the past glories in twenty previous SBAC exhibitions. If this kind of unhappiness was shared by the British, the gloom was not evident even on the wettest day of the week-long event. For good cheer the show sponsors looked to the arithmetic on the steady good sale of their aeronautical products in foreign countries. The export rate is being held at a high level and probably will stay there so long as British engines hold their popularity in foreign-built airframes. These people have a sense of humor and their own wags say SBAC now stands for the "Society of *Both* Aircraft Constructors." They proceed from this to a prediction that someday it may designate the "*Single British* Aircraft Constructor." It was only the foreign observers who seemed to repeat it without tongue in cheek.

One American on the scene made the observation that, while some of his fellows were deprecating what they called the absence of any technical breakthroughs in the Farnborough demonstration, *The Economist,* prominent London business weekly, saw history in the making. And *The Economist* was right. The first public flying demonstration of the Short SC.1, a jet plane that goes straight up, hovers, and converts to forward flight, most certainly proved that conventional airports and traffic control systems have a limited life. Its military application has equally important possibilities. In the case of the Short VTOL there are five Rolls-Royce RB.108 engines. Four of them provide the vertical lift, and the fifth is there for forward propulsion. At the same time the lift engines are used to complement their single forward flight unit because they can be inclined to add thrust or tipped backwards, in the latter case to brake the airplane before landing. The British have another VTOL project, the Hawker P.1127, that was not ready to fly at the Farnborough show. This version will have a single engine with rotating gas ducts at each corner. These will send their blast downward to get airborne, move to horizontal for forward thrust.

Air Chief Marshal Sir Thomas Pike, Chief of Staff of the Royal Air Force, says his planners are looking forward to the time when they will have a VTOL transport that can haul 150 troops and bulky Army equipment. They also have a requirement for a fighter-bomber that doesn't need airports and can go anywhere in the world at supersonic speed. Air Marshal Pike, unlike some of his allied military planners, does not see the limited-war requirement as one that will improve the equipment of

(Continued on page 21)

Today is obsolete...

The "breakthrough" of every sunrise symbolizes the day-to-day *race with obsolescence* which challenges our nation and its scientific teams. While many achievements today are awe inspiring, no technological group or organization can rest on its laurels in this highly-competitive cold war era.

To reach *beyond* today's horizon, with discoveries that are meaningful for tomorrow, is the goal of Sperry research. Toward continued progress in air and sea transportation and in critical aspects of national defense, our program encompasses research-in-depth under such headings as electromagnetic radiation, gyroscopic phenomena, electron beam interactions, materials sciences, mathematic analysis.

To some, the promise inherent in much we explore today may sometimes be hidden in such exotic terminology as magnetohydrodynamics, cryogenics, spin resonance, ion propulsion, plasma physics. In these and other fields, our resolve to bridge the gap between initial inquiry and reduction to practice will expedite the widespread application of these new technologies.

Research at Sperry will make continuing, significant contributions to our rapidly expanding environment as the nation and the free world seek a more peaceful and meaningful way of life. General Offices: Great Neck, N. Y.

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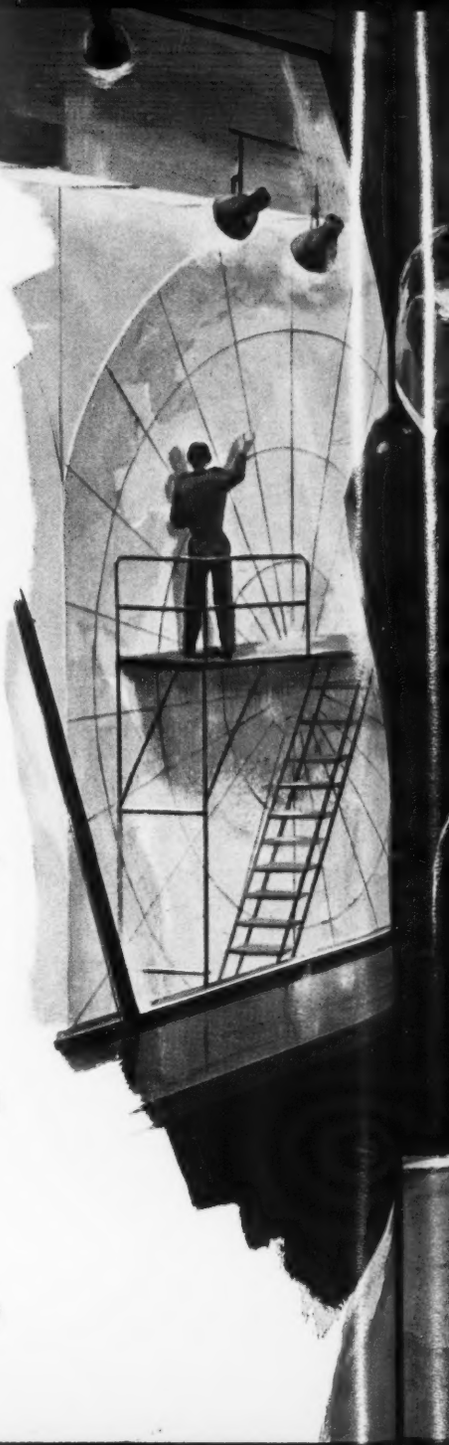
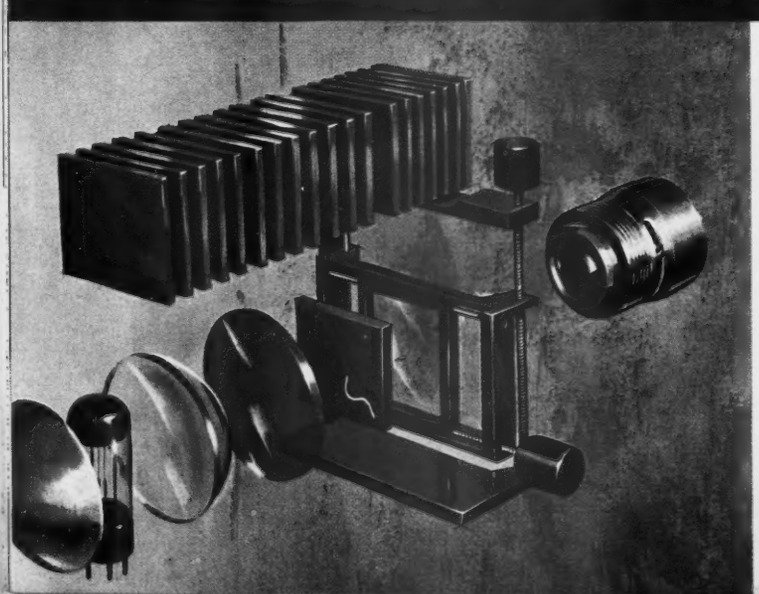


An ICONORAMA System is being installed at SAC (Strategic Air Command) Headquarters to give military commanders visual information regarding enemy attack. ICONORAMA, designed and developed by Fenske, Fedrick & Miller, Inc., is a data processing and plotting display system which records the movements of multiple objects and projects their paths on a display area.

Two and three-dimensional ICONORAMA Systems display on any size screen tracking information received on any number of targets simultaneously. The tracks or plots are color coded for identification purposes and additional alphanumeric information is generated and displayed automatically for further identification or to notate events. Utilization of existing telephonic or teletype circuits permit uncomplicated, inexpensive methods of transmission and reception of data.

Through an interlocked ICONORAMA System, data gathered by radar outposts such as BMEWS (Ballistic Missile Early Warning System) is simultaneously received by the NORAD (North American Air Defense Command) Communications Center, the commander of Strategic Air Command Headquarters in Omaha and the Pentagon in Washington.

This ICONORAMA System represents the terminal end of a 7000 mile electronic "funnel" which provides the earliest possible warning of enemy attack, thus enabling SAC to provide immediate retaliatory action. This installation of ICONORAMA constitutes a major step forward in the data processing and display field and increases the efficiency of our Military Forces in the defense effort of the North American Continent.



ICONORAMA
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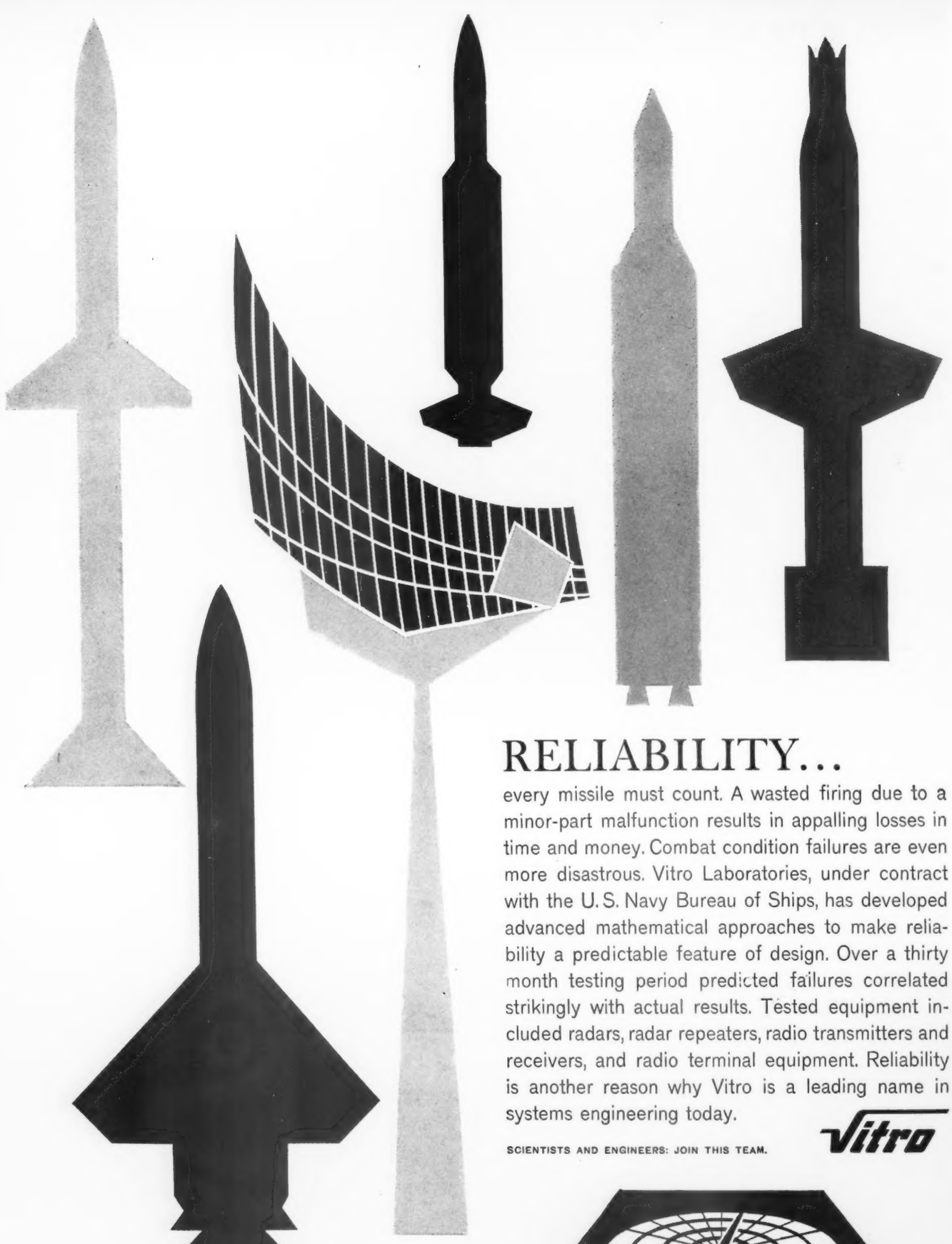

RELIABILITY...

every missile must count. A wasted firing due to a minor-part malfunction results in appalling losses in time and money. Combat condition failures are even more disastrous. Vitro Laboratories, under contract with the U. S. Navy Bureau of Ships, has developed advanced mathematical approaches to make reliability a predictable feature of design. Over a thirty month testing period predicted failures correlated strikingly with actual results. Tested equipment included radars, radar repeaters, radio transmitters and receivers, and radio terminal equipment. Reliability is another reason why Vitro is a leading name in systems engineering today.

Vitro

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surface forces alone. One of the principles of intervention, he says, always has been the idea of getting airpower to the scene with just as much urgency as soldiers. He points out that the handicap in interventions of this type in the past always has been the lack of airfields.

There is no clear indication that the British government has a plan to push VTOL developments despite the urgency both military and civil customers put on the project. As in the case of the simple lack of new and amazing things at the Farnborough show, this is not something peculiar to Great Britain. The simple truth is that the days of mass line production of airplanes is gone. Along with fewer units has come an era of immense complexity and high development costs. And the British must be given credit for doing something about it even if that has changed the headlines coming out of Farnborough. From the beginning of 1958 until this year's exhibit a score or more mergers have taken place until now there are only three airframe manufacturing groups, the Hawker Siddeley Group, British Aircraft Corporation, and Westland Aircraft. The latter is concerned chiefly with helicopters. There are two main engine firms, Bristol Siddeley and Rolls-Royce. There still are about ten smaller firms outside the amalgamations. The problem that faced the SBAC was not different than the one which faces the business in the United States, except that the government's interest is more direct, a fact that is evident at the Farnborough exhibit. At the same time inhibitions are cast aside, and the SBAC puts all its effort here into selling. If the public gets a glimpse of some new airplane or a missile system,. that is a good byproduct but not the primary aim of big government support for an industry trade show. The British know the manned airplane is here to stay. They are proud of the fact that most of the turbine-powered airliners on order or in service are made in England and that more than sixty-three percent will be powered by British engines. They intend to keep it that way; they intend to get more of the market.

There is a lot of speculation, so far no decision, on the future of Farnborough. Commonest prediction is that the show will go semiannual, alternating its date with the bigger and more popular Paris exhibition. More important to manufacturers in other countries is the strong possibility that Farnborough will be opened up to other nations to a limited degree. If an American or French or German aircraft manufacturer uses British-made components in his design he will be invited to display the product. What this means is that Farnborough, where the acres of tents are full of salesmen with order books, will welcome new competition.

There is a good deal to be said for this approach, which could be traced in its parenthood to the case for private enterprise as preached but not always practiced in other countries.

(Continued on following page)

Photo courtesy British Information Service.

This is the Black Knight, a rocket shown by the British Ministry of Aviation. It is used to study reentry problems and is equipped with a second propulsion stage to boost its speed just before it reenters the atmosphere.

Photo courtesy British Information Service.

History of the Short SC.1, VTOL jet, goes back to the famous "Flying Bedstead" of 1954. Its performance at the Farnborough show in 1960 may be the most significant advance for aviation since the British made the first jet.

Photo courtesy British Information Service.

Model of the SR.N2 Hovercraft, product of Westland Aircraft, drew a big crowd in the exhibition hall. Designed for up to sixty-six passengers, it has two large fans and two propellers to provide lift from the water and thrust.

Wanted: Leadership

WASHINGTON, D. C.

It is almost a month until Election Day as this issue of AIR FORCE/SPACE DIGEST goes to press. So far, if the "space race" and the "missile lag" are significant issues, they have been sadly neglected in the campaign. There have been some efforts to prod the candidates, but they have not resulted in the kind of stuff of which votes are made, which confirms our editorial prejudice of many months ago. There has been some talk about our "prestige," which seems to have been provoked by the ungentlemanly conduct of an outstanding Communist and an outstanding Cuban beatnik in New York.

One candidate says our prestige is high; his opponent says it is low. The President of the United States says he wants somebody to explain prestige to him. Scotty Reston of the New York *Times* has obliged with a story: When a drunk in a bar shouts, "I can lick any man in the house," and Joe Louis steps forward and the man recognizes Joe and retreats—that's prestige.

On the basis of that definition there should be more discussion of the "space race" and the "missile lag" before we vote. The candidates have the material, and there is an outside chance it will be blasted loose, possibly with an assist from people like Nelson Rockefeller and Stuart Symington, who are active in the political camps.

Recognition of the fact that what we do in the space and missile area has something to do with prestige has been reasonably common outside the Administration at least for the three years since Sputnik I went roaring off the pad. One significant yardstick laid on competent opinion about the space effort was put there by the *Harvard Business Review*, a publication that, so far, has not had its patriotism challenged because it published the facts.

In a survey of the opinions of nearly 2,000 American executives, Professor Raymond A. Bauer of the Harvard Business School found that most of them want a vigorous space program. They are willing to give the effort priority over a cut in taxes. They expect immense benefits from space exploration. They do not find much fault with the program, but what fault they do find is with its execution. Far from scoffing at satellites as new-fangled basketballs, they believe "anything is possible" as a result of space research. Professor Bauer does not editorialize about the results of his study, but he says the most essential finding was that "the present state of opinion offers an opportunity on which a vigorous leadership can capitalize, but it is not something to be regarded complacently."

The thought that there is some fragility about the support that can be won by aggressive leadership springs from the feeling that the ordinary citizen cannot calculate just what kind of support should go into the effort. A reply chosen as typical said taxes can be raised without wrecking the economy, but guidance is needed—and it can come only from the White House—as to which programs deserve support on the sometimes conflicting ground of technological advances or national security. If the successful presidential candidate has any doubt about influential support for an aggressive space program he can abolish them by heeding these opinions from the Harvard study:

- Eighty-nine percent put no limit on what can result from the space program.
- Fifty-nine percent believe politicians put scientific advancement ahead of using the issue for political profit.
- Eighty-six percent believe a man in space will be of more benefit than robot machines.
- Eighty-five percent see space as a new frontier, where research will have a profound effect on our economic growth.
- Fifty-seven percent see a need for a single program with a single director.
- Sixty-seven percent believe the country that controls space also can control the earth.
- Eighty-nine percent believe we are drawn into space by the desire to know and conquer.
- Ninety-two percent believe there are new horizons in space which are not recognized by most people.
- Seventy-eight percent disagree with the idea that competing with Russia in the space race is nonsense.

These figures represent the replies of executives who hold these opinions either wholly or to some lesser degree; in almost every case the percentage of neutrals was negligible. The lesson for the incoming Administration is that there is substantial support for real leadership and that some of the recent attitudes are considered wrong. Only six percent, for example, agree wholly that the idea of a space race with Russia is nonsense.

What do these executives expect as the payoff from a space program? Accurate long-range weather forecasting, Professor Bauer reports, is seen as almost certain by fifty-three percent and as very likely by thirty-four percent. Only one percent say it never will happen. Improved communications are seen as almost certain by sixty-nine percent and as very likely by twenty-five percent. The biggest block of skepticism appears over the possibility of colonizing other planets or using them, or perhaps the moon, as sources of minerals.

The Harvard study was able to identify five general reasons for supporting the space program. They are listed as (1) military and political considerations, (2) prospect of economic payoff, (3) a general sense of adventure, (4) desire for increased knowledge, and (5) the wish to win the race for prestige with the Soviet Union. In order of priority pure science was considered the single purpose of space research that outranked the military reasons. As might be expected, the executives had a tough time properly identifying which space projects at present are under the military and which ones are run by the National Aeronautics and Space Administration.

Professor Bauer also concluded that the executives drew a distinction between military and civilian objectives but not necessarily between the existing programs. He does not appear to have tried to determine whether or not they feel separate programs are necessary. On the other hand he did determine that the consensus is that we are not doing as well as we can in the space race, and the reason is an inefficient and ineffective use of our resources.

There was some discussion in the survey of the chronic problem of money. It was found that seventy-one percent of the men favor a higher budget for NASA, and only twenty-eight percent would give more money to the military. Professor Bauer suspects opinions are not well crystallized in this area and that the military has more support than his survey figures indicate.

As the political campaign swings to a close there has appeared no evidence that the kind of facts dug out by the Harvard study are influencing the candidates. Even the press, which has been doing a lackadaisical job of covering the show, failed to pick up the survey results in an effort to stimulate the campaigners. It also has failed to use other things on the record, such as the Rockefeller Committee Report, the Gaither Report, and any number of research studies and congressional hearings. If we get the leadership, do we deserve it?—END

ONE PULL OF THE DIAL AT HQ

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This new development is now being tested for military and non-military defense applications. It will also be useful to volunteer fire departments, power companies and for Civil Defense warning.

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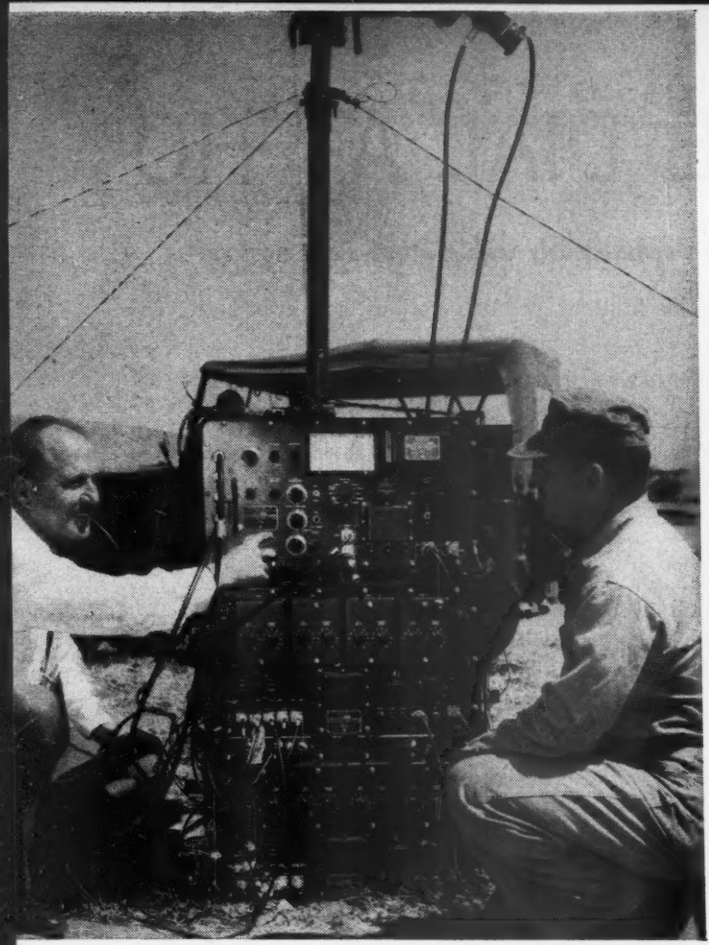
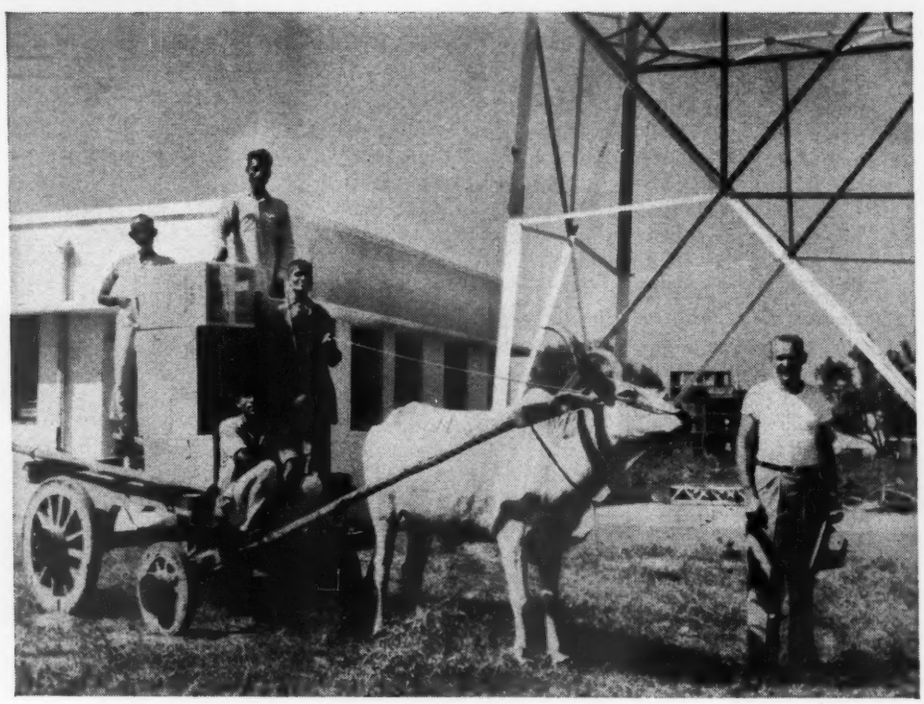


Instructing Marine Corps personnel in portable microwave communications equipment, AN/TRC-27.

In Germany, checking a proposed radar site for masking objects, preparatory to installation.



Delivering AN/CPS-9 weather radar parts for the Department of Meteorology, New Delhi, India.

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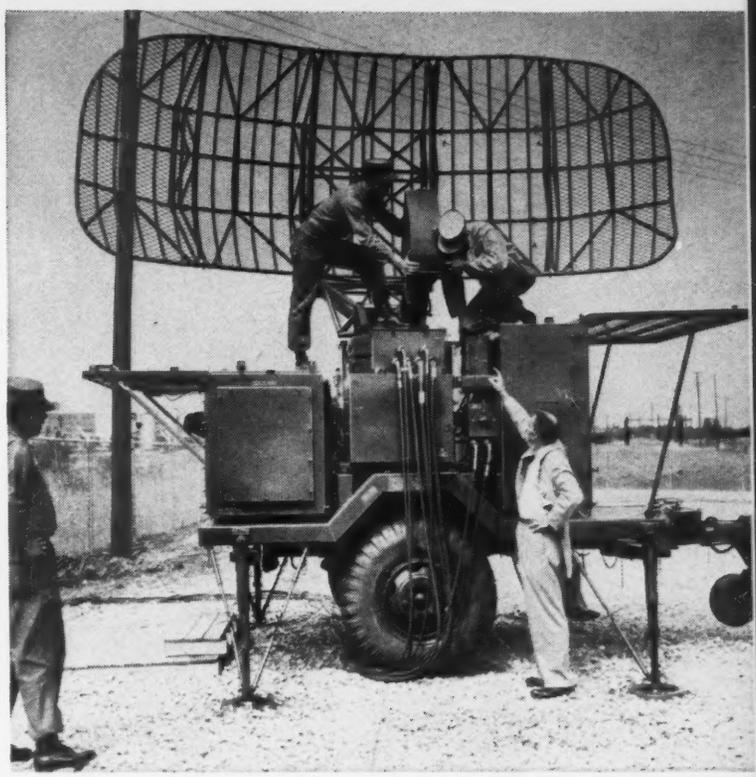

About to board a B-47, this Raytheon field engineer provides technical assistance on electronic countermeasures equipment.

(U.S. Navy photo)

On Midway, Navy technicians receive instructions on adjustment of airborne navigational equipment.

the Armed Services and government agencies,

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News,
Views
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AEROSPACE WORLD

Frederic M. Philips
ASSOCIATE EDITOR

Three US aviators set new records this month. Two intercontinental missiles flew record distances. The first Ballistic Missile Early Warning System (BMEWS) site went into operation. A communications satellite was placed in orbit. And two Air Force officers completed a month-long "spaceflight."

• Lt. Col. Thomas H. Miller, a Marine Corps pilot, raced his McDonnell F4H-1 Phantom II Navy fighter over Edwards AFB, Calif., at 1,216.78 mph on September 5. The speed run over a 500-kilometer closed course bettered a previous mark in that category set by Air Force Capt. George E. Edwards, Jr., flying a McDonnell RF-101 Voodoo, in April 1959. The earlier figure was 816.279 mph.

Three weeks later, on September 25, Navy Cmdr. John F. "Jeff" Davis roared into the record books once more in another Phantom II. He attained a speed of 1,390.21 mph over a 100-kilometer closed course. Past fastest here was the 1,216.48 mph at which USAF's Brig. Gen. Joseph H. Moore streaked in a Republic F-105 last December. Also eclipsed in Commander Davis' flight was a Russian-claimed record not yet in the books. The Soviets reported that a Red Air Force fighter recently got up to 1,298.70 mph over a 100-kilometer course.

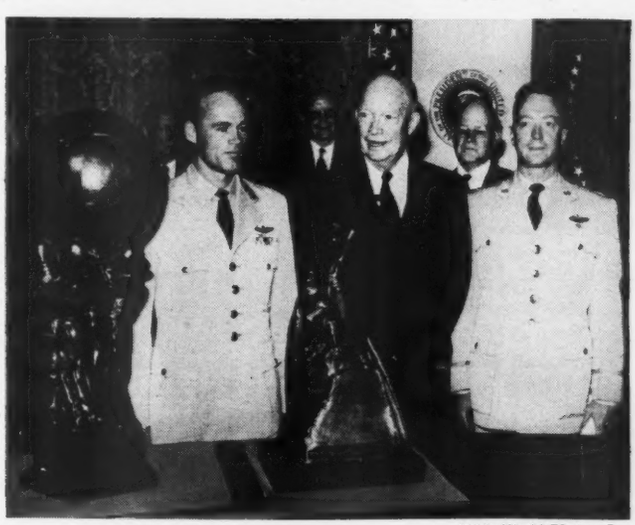
One of the world's top woman aviators set a new altitude record for light planes on September 20. Miss Jerrie Cobb, last year's "Woman of the Year" in aviation, took a two-engine Aero Commander 680F to 37,010 feet, still a long way up for a light aircraft. The old record for this weight class was 34,862 feet. To survive seven miles up, twenty-nine-year-old Miss Cobb wore three Arctic survival suits, fur-lined boots, and three pair of gloves. The flight took place over Southern California. Miss Cobb, who participated in the first World Congress of Flight in 1959, earlier this year underwent man-in-space-type physical tests at the Lovelace Clinic, N.M. The tests led to news accounts that the young lady had qualified to rise to astronautic heights. Both she and NASA officials have been at pains to deny that any such woman-in-space plans exist.

• While their younger but more sophisticated brother, Minuteman, was being introduced at AFA's National Convention in San Francisco, the two big boys of America's missile arsenal took long-distance flights out over the Atlantic Missile Range.

Atlas, the free world's first operational ICBM, went 9,000 miles from Cape Canaveral in a September 19 launch. It was the second time the Convair missile had gone to this record distance. The first 9,000-miler was on May 20, establishing the world's missile distance mark. This latest shot landed within two miles of target point in the Indian Ocean some 1,000 miles southeast of Cape Town, South Africa. The missile took fifty minutes to zoom more than a third of the way

(Continued on page 29)

Record setter. Navy Cmdr. John F. Davis established a world 100-kilometer closed-course speed record of 1,390.21 mph in a McDonnell F4H-1 Phantom II fighter plane over Edwards AFB on September 25. Earlier, Marine Lt. Col. Thomas H. Miller set 500-km. speed record in Phantom II.



Wide World Photos, Inc.

President Eisenhower stands between, left, USAF altitude record-holder Capt. Joe B. Jordan, and famed balloonist-parachutist Capt. Joseph W. Kittinger. President presented year's Harmon International Aviation Awards to two Air Force officers in a White House ceremony on October 3.

New AiResearch system delivers nitrogen in liquid form from storage system to cooling area

Now units requiring cryogenic cooling no longer need be designed with allowances made for bulky expanders or adjacent storage tanks.

The new AiResearch system transfers the coolant *in liquid form* to a point of use *25 feet or more away*. The liquefied gas passes through an uninsulated, small, flexible tube which can be bent over and around obstructions. Because the storage system can be placed anywhere, space limitations are overcome and vehicle installation problems are simplified.

The complete system includes the cryogenic liquid container, pressure and flow controls, the liquid transfer tube and cooling adapter. The system can be operated without external power. It can be used with missile, aircraft, space or ground based units and can be converted to a closed-cycle system with the addition of a small gas liquefier.

AiResearch has pioneered many new developments in the cryogenic field. It is presently engaged in work on systems utilizing helium, hydrogen or neon as coolants, and cryogenic systems for zero G operation.

• *Please direct inquiries to Los Angeles Division.*

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around the world and plop into the pickle barrel. Early in October came word that the Atlas' operational range is expected to be upped by 3,000 miles over these record shots by sometime next year.

The Titan made its longest flight on September 29 in continuing tests slated to bring the Martin-built missile to operational status next year. The shot at the end of September aimed to send Titan into the Indian Ocean as well. The missile, according to figures released some while back, is slated to have a range of at least 10,000 miles in later operational versions. This time premature shutdown of the second-stage engine dropped it 6,000 miles from home, about a thousand miles farther than it has gone before in tests—which have not aimed primarily at distance flights. The operationally configured Titan "J" has undergone three successful test shots.

In other major missile news, a milestone was passed when the Navy submarine *Patrick Henry* fired the first operationally configured Polaris intermediate-range missile from underwater off the Cape on September 16.

• North America became a somewhat safer place in which to live on October 1. The BMEWS station at Thule, Greenland, went into operation. The Thule station is the first BMEWS site to be completed. Two others are under construction, at Fylingdales Moor, Great Britain, and at Clear, Alaska. The Thule site consists of four detection radars with ranges in excess of 2,000 miles. Returns from radars are automatically fed into electronic computers that calculate in thousandths of a second the course and speed of missiles. The data is then instantaneously passed back to North American Air Defense Command and Strategic Air Command Headquarters in the US by a complex communications system. Each radar antenna is larger in length and width than a football field. Operational responsibility for the Thule site was transferred October 1 from the Air Materiel Command's Electronics Systems Center to NORAD. AMC is responsible for implementing the BMEWS program to the point of operation.

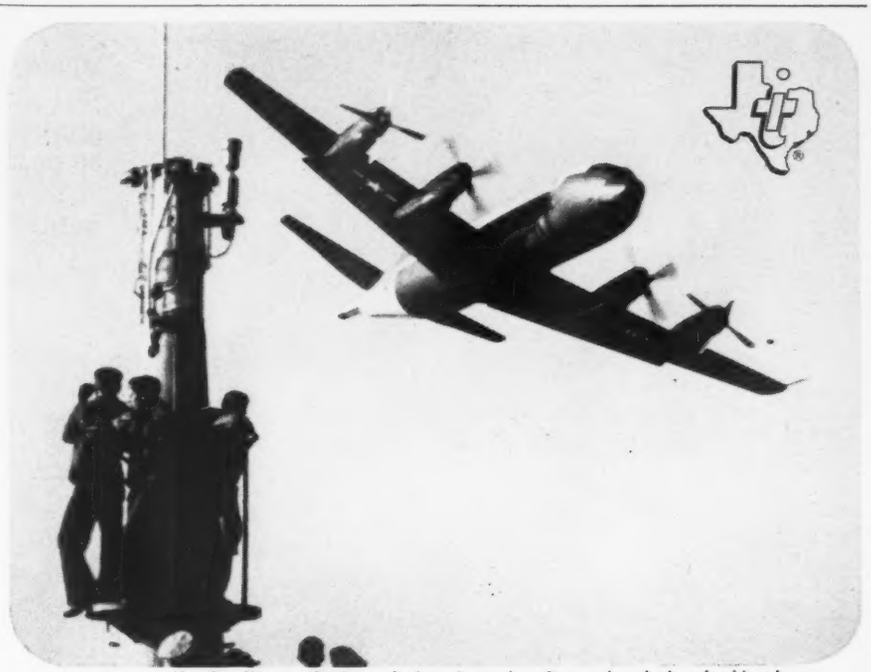
• The United States scored another space communications success on October 4 when a Thor-Able-Star booster sent an Army-developed Courier I-B active communications satellite into orbit. Courier is a fifty-one-inch-diameter sphere enclosed in a blanket of cells for transforming solar energy to electricity. The electricity operates communications equipment within the orbiting satellite. Courier differs basically from NASA's Echo I, world's first communications satellite launched August 12. Echo's aluminized skin reflects messages beamed from earth back to earth. Courier receives, stores, and transmits messages on command. Less than an hour after launch, it transmitted a greeting from President Eisenhower to the United Nations. An earlier Courier I launch attempt failed in August. For the workhorse Douglas-Air Force Thor, Courier I-B marked the 100th launch, military and scientific combined. Thor has provided the boost for sixty percent of the payloads the US has put in orbit.

Gen. Nathan F. Twining, Chairman of Joint Chiefs of Staff, retired on September 30. He made significant farewell address to New York group.

Army Gen. Lyman L. Lemnitzer was the successor to General Twining at the head of Joint Chiefs. Retirement came after forty-four years in uniform.

Other returns in the space race were not so gratifying. NASA failed in

(Continued on page 31)



U. S. Navy P3V-1 antisubmarine aircraft produced by Lockheed — equipped with TI-built AN/APS-80 surface search radar, AN/APA-125A indicator, and additional gear (nomenclature classified).

AIRBORNE SUB-HUNTER USES TI ASW SYSTEMS

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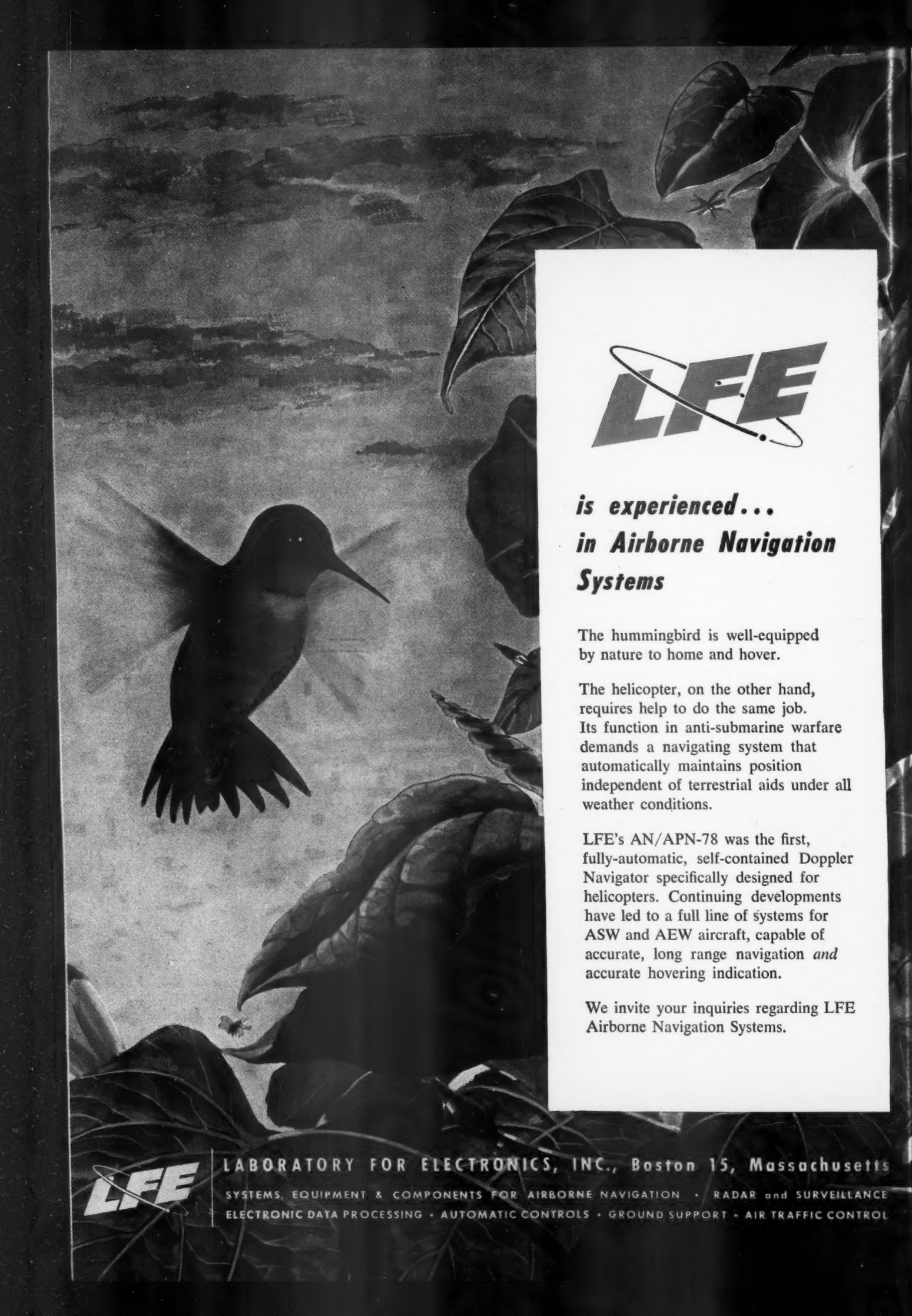

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an attempt to place its Pioneer VI satellite in lunar orbit on September 25. The satellite burned out in the earth's atmosphere following second-stage failure of the Atlas-Able booster. The 387-pound, instrument-packed spacecraft fed back information to ground observers at the Cape for seventeen minutes, then ceased sending before it was well under way on its projected 240,000-mile trip to the moon. Russia has scored three Lunik moon-shot successes to date, three more than the US at this point.

On October 11, USAF missed in a try at putting the nation's first reconnaissance satellite, Samos, for Satellite and Missile Observation System, into orbit. An Atlas D booster boomed photo-equipment-laden Samos I off a pad at the new US Navy Missile Facility, Point Arguello, Calif. The launch appeared to have gone well, but two hours later the Air Force announced that Samos I failed to enter orbit.

Discoverer XV went up a month earlier from Vandenberg. The September 13 launch was a success, and the capsule was released from orbit on schedule for recovery in the Pacific. In the preceding weeks, Discoverer XIII's capsule was picked up at sea and Discoverer XIV's plucked out of the air, first two recoveries of objects from space. Russia made man's third such recovery, this one of an animal-bearing capsule, immediately thereafter. In the case of Discoverer XV, however, US recovery planes and ships failed to connect with the capsule. It was believed to have gone down at sea.

• Two Air Force pilots completed a thirty-day, eight-hour, and twenty-minute "spaceflight" on September 15. Capt. William D. Habluetzel and 1st Lt. John J. Hargreaves stepped from an eight-by-twelve steel tank spacecabin-simulator in which they had remained long enough to make a trip to the moon, spend thirteen days exploring it, and return to earth. The simulated space test, part of USAF's man-in-space activities, was conducted at the Air Force School of Aviation Medicine, Brooks AFB, Tex. Through the mouth-plus, the two flyers subsisted on eighty-five pounds of dehydrated food and twenty-two gallons of water. The water supply was supplemented with recycled urine processed by special equipment in the cabin. Captain Habluetzel and Lieutenant Hargreaves read, performed work problems, operated simulated spaceship controls. They conducted daily physical exams on themselves and reported the results. Doctors in charge of the experiment thought it went "exceedingly well." The two airmen, each several pounds lighter as a result of the test, said that through the days in the cabin they "thought a lot about what people will actually go through when they fly a spaceship." The two were honored after their release at the AFA National Convention, along with other persons who made notable contributions to aerospace progress in the past year.

World's fastest aircraft in their classes in group photo over California. Top to bottom, they are world straightaway speed champ, the F-106, the B-58, the 880 transport. B-58 is supersonic, 880 can hit 615 mph. Convair makes them.

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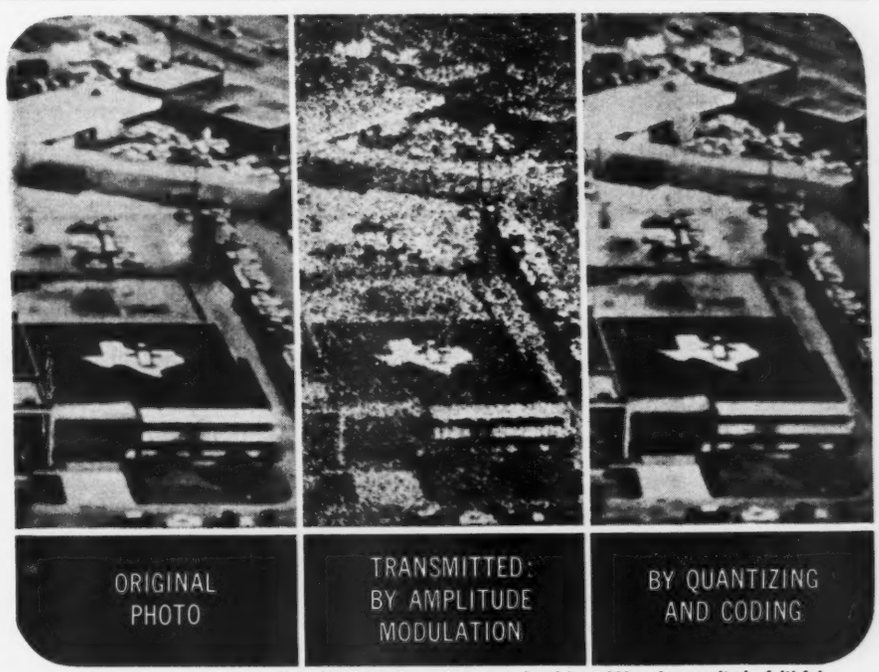
Gen. Nathan F. Twining left sage words of farewell behind him when *(Continued on page 33)*



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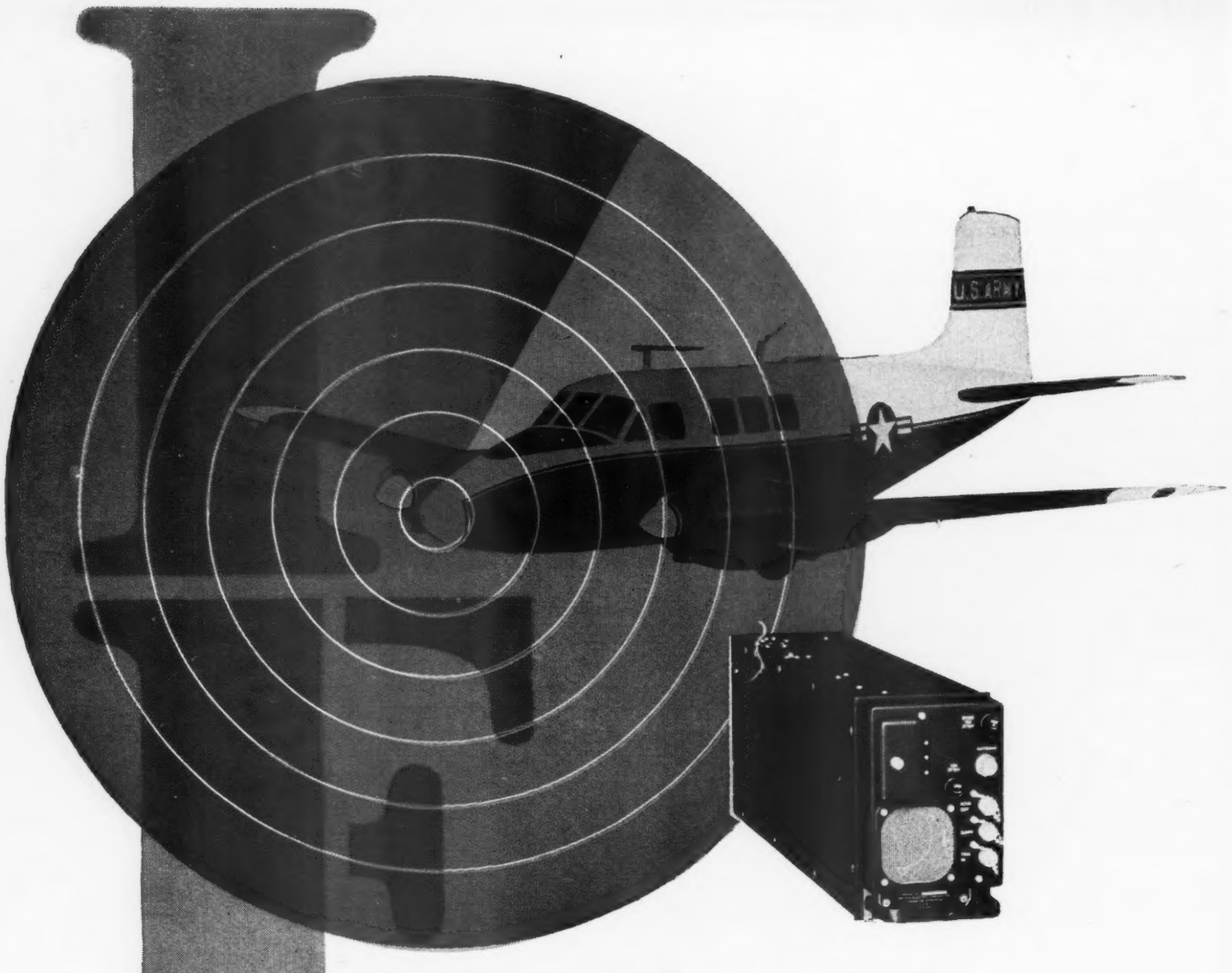

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Wilcox has produced these airborne units in quantity and on schedule for Army installation.

The AN/APX-44 features minimum size and weight, modular construction, a crystal-controlled receiver and cavity-tuned transmitter. It is indicative of the electronic systems capabilities and experience of Wilcox.

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he retired as Chairman of the Joint Chiefs of Staff on September 30.

"Our national objective must remain clear," he declared in a New York speech. "It is to develop and hold power sufficient to win in all aspects of military struggle, all-out or limited. . . . The American capability for decisive, war-winning response to any attack must be kept sure, whatever the costs. It is the only reliable guarantee of the peace. Forces that cannot win will not deter."

General Twining continued, "The forces in being and the forces coming along are, in my judgment, of the right mix. There can be no serious question of the national capacity to maintain the proper balance of forces in the years ahead. We may have to tighten our belts a notch, but this would scarcely be a national disaster. Our position right now is a strong one and it can be maintained indefinitely if the national will remains strong. . . . We must at all times place our military emphasis on the clear, unequivocal US ability to destroy Russia, and China, if we are attacked. That is the best deterrent to all forms of Communist aggression."

Of his own retirement, sixty-three-year-old General Twining said "the adjustment may present its difficulties" but "many before me have worked this out and I'm sure I can too."

General Twining spoke before the National Security Industrial Association in New York September 28. Two days later, after forty-four years in uniform, he retired in an all-service ceremony at Bolling Field outside Washington. President Eisenhower presented him the Distinguished Service Medal prior to retirement. Army Gen. Lyman L. Lemnitzer succeeded to the post of JCS Chairman.

☆

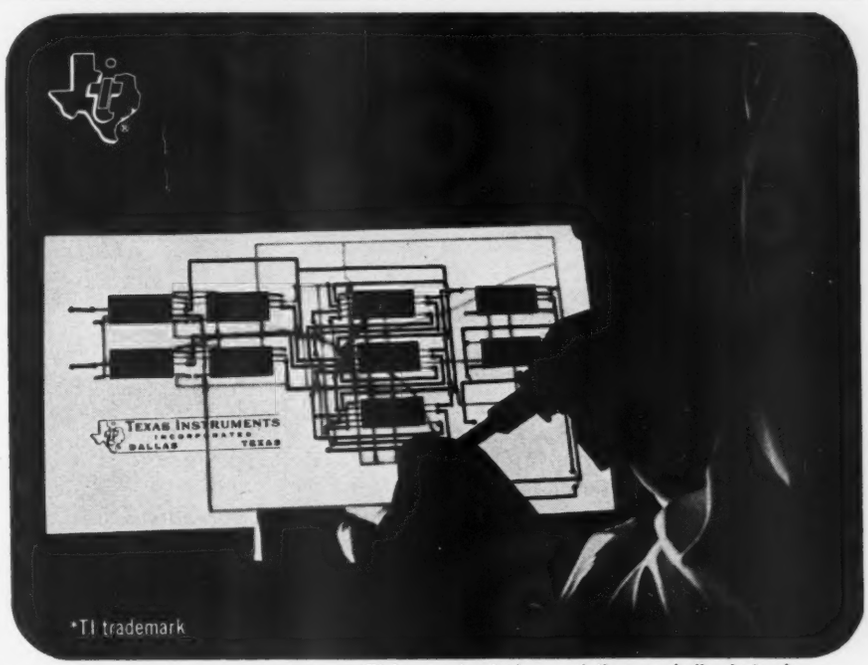
ELSEWHERE IN THE AEROSPACE WORLD:

The Department of Defense announced at the end of September that 3,153 officers will have to be taken off flight status in the armed forces by early next year. There are presently 102,199 officers on flying status. DoD ordered the number cut to 99,046. USAF must reduce by 2,295, the Navy by 560, the Army by 182, the Marines by 116. New USAF total will be 70,620 officers in flying status. To the average individual dropped from the rolls, the loss in salary will amount to about $2,500 a year.

As we went to press, an announcement was expected that additional funds would be made available for USAF's B-70 bomber project. If the amount exceeds the $84.3 million left out of what Congress provided in extra money above the Administration defense budget, the difference would be taken from funds added by Congress for interceptor aircraft. The De-

(Continued on page 35)

Twenty years have passed since Britain's RAF turned back the Luftwaffe and won World War II's Battle of Britain. This Spitfire, a relic of war over Britain, went on display in Ottawa, Canada, last month to mark anniversary.



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Ready and rugged... it's the Hiller E4. It commands 305 hp, which it can handle full time, to full advantage — and at altitude — whether transporting men or machinery. The most powerful U.S. 4-place helicopter in the air today, only the E4 has the safety reserve of power for vertical climb when fully loaded... and at 820 feet per minute!

The E4 is sister ship of a famous line of workhorses, the U.S. Army H-23D Raven, already in missile site support, and the record-setting 12 E, first choice of commercial operators. Both have proved themselves in availability, performance and low maintenance. Following in their path, the E4 has already scored a new record for helicopters with a 2,850 mile flight at 94 mph average true air speed. It's this kind of versatile performance that backs up the E4's wide margin of safety.

For USAF missile site support, the Hiller E4 offers new standards of efficient, dependable transportation for personnel and quickly converts to fly pickup-truck-size loads of high priority cargo. And with it all, the E4 is the lowest cost 4-place helicopter in the air today... both in original price and throughout its life.

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fense Department had programed additional spending of $194 million for airlift capability, $82.9 million for airborne alert, and $83.8 million for the Samos satellite. These sums were not requested but were voted by Congress.

Navy Cmdr. Forrest Petersen became the fourth man to fly the X-15 on September 23. He was one of four new pilots, one of them USAF Capt. Robert A. Rushworth, assigned to the USAF-Navy-NASA rocket plane test series.

President Eisenhower awarded this year's Harmon International Aviation Awards to two Air Force record holders in a ceremony on October 3. Recipients were manned-aircraft altitude record-holder Capt. Joe B. Jordan and parachutist-balloonist Capt. Joseph W. Kittinger.

The 4520th Combat Crew Training Wing, Nellis AFB, Nev., won William Tell 1960, USAF Worldwide Tactical Weapons Meet held at Nellis during the last week in September and the first in October. The Nellis team was defending champion in the all-around aerial competition. Top tactical unit and meet runner-up was the 18th Tactical Fighter Wing, Kadena Air Base, Okinawa. "Top gun" of the meet, outstanding individual participant, was Capt. Aubrey C. Edinburg of the Nellis team.

Two Air Force pilots and a US private pilot received awards at the Fédération Aéronautique Internationale meeting in Madrid in October. The three were: General Moore, who set the 100-kilometer closed-course record last December; Maj. Joseph W. Rogers, Air Defense Command pilot who flew an F-106 to a straightaway record of 1,520.9 mph in December; Richard E. Schreder, Toledo, Ohio, for establishing three world marks in a single-place sailplane.

USAF's determined safety campaigning continues to pay off. Maj. Gen. Perry B. Griffith, the service's Deputy Inspector for Safety, announced recently that for the period from January 1 to August 31 of this year, USAF achieved an all-time record low rate of 5.9 major aircraft accidents per 100,000 flying hours. This was a thirty-two percent improvement over the same period last year and thirty-six percent better than the record ten years ago. In the first eight months of 1960, the Air Force experienced 165 deaths in eighty fatal accidents compared with 256 deaths in 125 fatal accidents during the like period last year.

AMC's Col. Harry Goldsworthy, formerly SAC deputy wing commander at Malmstrom, AFB, Mont., has been named first Minuteman site activation task force commander to head site activation at Malmstrom.

DoD designated the Inspector General of the Air Force, Lt. Gen. Joseph H. Carroll, to investigate the defection to Russia of two National Security Agency code employees, Bernon H. Mitchell and William H. Martin, some months ago.

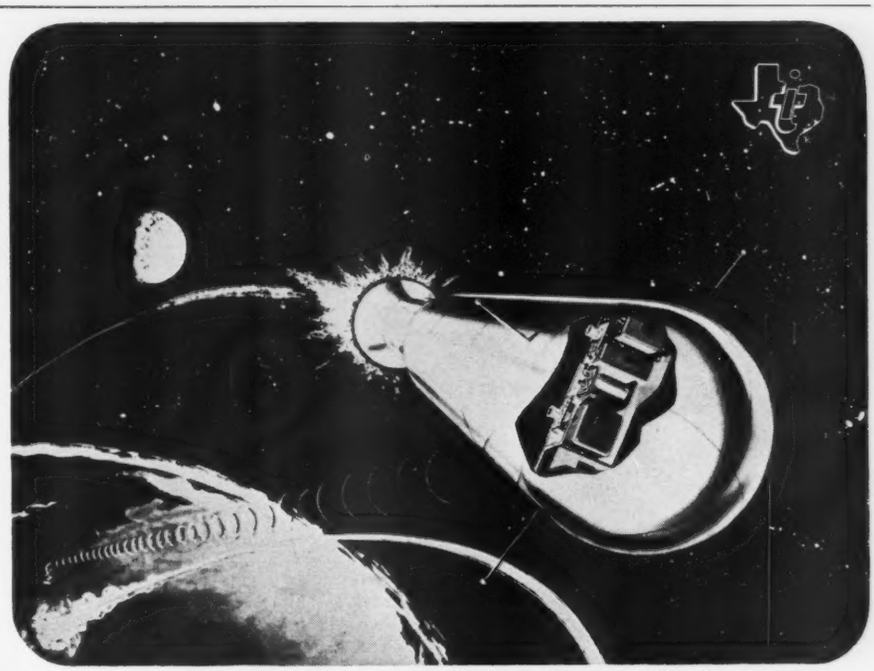
☆

STAFF CHANGES. . . . **Brig. Gen. Milton B. Adams,** from Deputy Assistant Chief of Staff for Guided Missiles, Hq. USAF, to Deputy Director of Systems Development, DCS/D, Hq. USAF, Washington, D.C. . . . **Brig. Gen. Theodore C. Bedwell, Jr.,** from Surgeon, Hq. SAC, Offutt AFB, Neb., to Commander, USAF Aerospace Medical Center, ATC, Brooks AFB, Tex., effective February 1, 1961. . . . **Maj. Gen. David A. Burchinal,** from Deputy Director, J-3 (Operations), Office, Joint Chiefs of Staff, Washington, D.C., to Deputy Director of Plans, DCS/P-P, Hq. USAF, Washington, D.C. . . . **Brig. Gen. Richard D. Curtin,** from Deputy Director of Systems Development, DCS/D, Hq. USAF, to Director, Office of Missile and Satellite Systems, OSAF.

Brig. Gen. Robert E. Greer, from Vice Commander for Satellite Systems, AFBMD, ARDC, Inglewood, Calif., to Director of the Satellite and Missile Observation System Project, OSAF, with duty station at El Segundo, Calif., retaining original duty as additional duty. . . . **Brig. Gen. Maurice C. Harlan,** from Deputy Assistant, to Assistant for Dental Services, Office, Surgeon General, Hq. USAF, Washington, D.C. . . . **Maj. Gen. Chester E. McCarty,** from Commander, 3d Air Force Reserve Region, CONAC, Robins AFB, Ga., to Deputy to the Assistant Chief of Staff for Reserve Forces, Hq. USAF, Washington, D.C.

Maj. Gen. Glen W. Martin, from Deputy Director, to Director of Plans, DCS/P-P, Hq. USAF, Washington, D.C. . . . **Maj. Gen. Joseph J. Preston,** from Commander, 72d Bomb Wing (Heavy), SAC, APO 845, N.Y., to Commander, 22d Air Division, SAC, Malmstrom AFB, Mont. . . . **Brig. Gen. James C. Sherrill,** from Assistant to Chairman, Office of Joint Chiefs of Staff, Washington, D.C., to Chief of Staff, Hq. MATS, Scott AFB, Ill. . . . **Maj. Gen. James F. Whisenand,** from Special Assistant to Chairman, JCS, Washington, D.C., to DCS/Plans, Hq. ARDC, Andrews AFB, Washington, D.C.

RETIRED. . . . Maj. Gen. James S. **Cathroe,** Gen. Nathan F. **Twining.**—END



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At 00h00m01s GMT, November 1, 1960, Martin logged its 724,620,000th mile of space flight

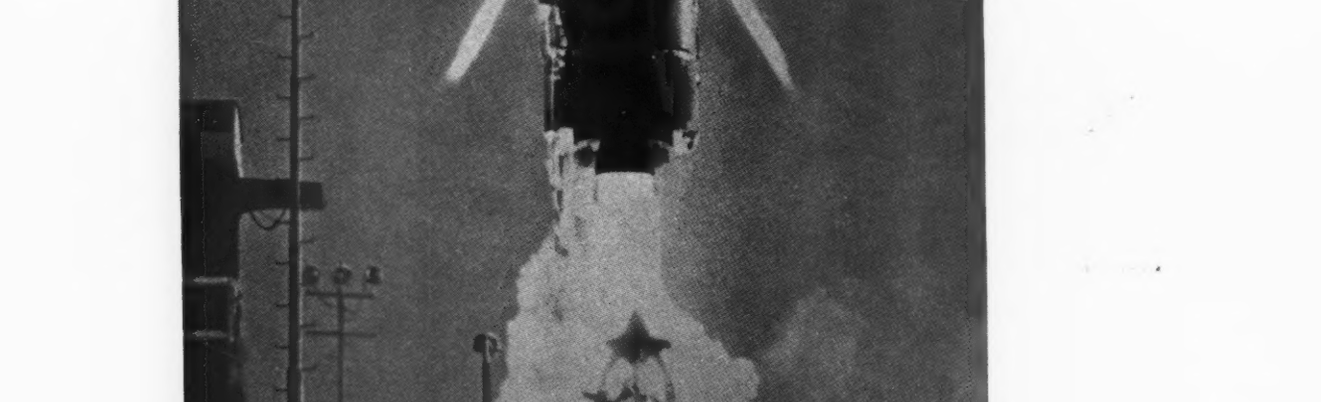
TITAN—*50 miles up: Official USAF Photo*

Air Force-Martin Titan, *giant American ICBM, has been chosen for a key role in space exploration. One of its first missions will be to launch USAF Dyna-Soar — manned aerospace craft.*

MARTIN

LIBRASCOPE MISSILE COMPUTERS

To the moon and back and wherever missiles fly. Librascope computers deliver ready answers for in-flight control ■ guidance, optimum trajectories, impact prediction, data reduction and analysis. Throughout flight... Librascope missile computers are uninterrupted by environmental extremes... and they will automatically and continuously check their own built-in accuracy. The compact size, minimum weight and performance of Librascope missile computers have earned them important roles in our conquest of space. For information on how Librascope advanced computer capabilities can answer your particular needs, write to Librascope, 808 Western Ave., Glendale, Calif. ■ Librascope, A Division of General Precision, Inc. ■ For engineering career opportunities, contact Glen Seltzer, EmploymentMgr.



computers that pace man's expanding mind

Aerospace Panorama accompanying 1960 National Convention contributed to downtown San Francisco skyline. Here workmen raise Thor-Able, one of Panorama's main elements. At rear is San Francisco's City Hall.

AIR FORCE
NOVEMBER 1960

Against a troubled world background, the Air Force Association convened its fourteenth annual National Convention at San Francisco late in September. Men whose lives are devoted to maintaining national and free-world strength and security conferred in an atmosphere of . . .

DETERRENCE ON DISPLAY

Frederic M. Philips
ASSOCIATE EDITOR

SELDOM had events on the international political scene more dramatically emphasized the need for overwhelming US military strength.

In New York, Soviet Premier Khrushchev ranted and table-pounded before the United Nations. Castro, who is not as funny as he looks, publicly hugged the Communist leader. On the other side of the Atlantic, further troubles flared in the Congo in disquieting postscript to seeming victory for pro-order, pro-Western leadership. On the other side of the Pacific, giant, menacing Red China shouted new hate slogans against the United States and new threats at Nationalist China —and edged closer to United Nations membership. On her doorstep, civil war erupted in little Laos, with Communists playing a prominent role.

Against this troubled world background, the Air Force Association convened its fourteenth National Convention at San Francisco from September 21 through 25. The key participants were men for whom these global events were more than headlines, men whose life work is maintaining national and free-world strength and security. The Convention's mission, underlined by the news of the world, was to contribute to this end.

These were some of the Convention's highlights:

- The Air Force unveiled its newest and potentially most effective intercontinental ballistic missile, Minuteman.
- The Association issued a potent, far-reaching Statement of Policy that called for new efforts to assure the United States is "second to none" in military strength. The Statement also condemned the "fallacious and dangerous strategic concept of so-called minimum deterrence" based on "the misguided belief that it is possible to deter war with forces that are not strong enough to win a war should it come." This theory, put forward by budget-servers and self-servers, AFA said, is "undermining the nation's defense effort."
- The major commanders who head the global Air Force issued their annual AFA Convention reports to the nation on USAF today and tomorrow. They met with newsmen at a series of press briefings that both made news and provided a vast quantity of background information for those whose job it is to keep the American people informed. The Secretary of the Air Force and the Chief of Staff delivered major

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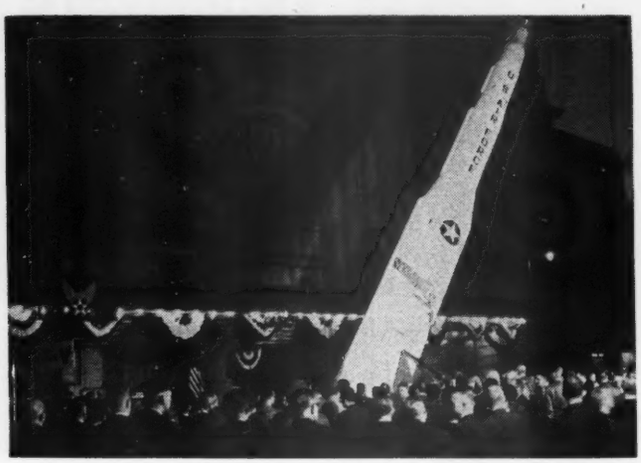


In first public showing, Minuteman ICBM, bathed in floodlights, is raised to its display position after impressive televised dedication ceremony on night of Panorama preview.

Newly elected Air Force Association President, prominent San Francisco attorney, Thos. F. Stack, delivers acceptance speech to assemblage at the annual Awards Banquet.

addresses. Other national leaders in industry, science, and education—including Jimmy Doolittle, Dr. Edward Teller, Dr. George Valley, and Dr. Simon Ramo—gave talks or took part in discussions in their areas of expertise.

• AFA brought together for this Convention an extraordinary group of the individuals who have written the history of aerospace from its very beginning to today's satellite era. A generous cross section of these personalities was introduced in a dramatic Awards Banquet program. Those presented ran the range from retired Maj. Gen. Benjamin D. Foulois, one of the first aviators in the Wright Military Flyer and Chief of the Air Corps in the 1930s, to the nation's top living aerial ace, Col. Francis S. Gabreski, to Capt. Harold E. Mitchell, pilot of the C-119 Flying Boxcar that historically fielded the capsule of the Discoverer XIV satellite in August.

• One of those who has been instrumental in fashioning today's world of aerospace, USAF Chief of Staff Gen. Thomas D. White, was named Aviation's Man of the Year for "outstanding leadership of our country's and the free world's primary deterrent" in the cold war. A host of other important honors went to men and organizations who have made distinguished contributions to aerospace progress—including AFA's own "family awards."

• In a major announcement, the Association set the second World Congress of Flight for Las Vegas, Nev., from September 16 through 23, 1962. It will take place in conjunction with that year's AFA National Convention and Aerospace Panorama. The first World Congress, much heralded here and abroad, was held at Las Vegas in April 1959.

• The Association of the United States Army and the Navy League joined with AFA in a joint statement from the Convention declaring that the US "can support whatever level of patriotic effort and expenditures is needed to defend our freedom." The joint statement, forceful in itself, marked a new departure in cooperation among the three organizations (*see box*).

• Seminars and addresses dealt with topics of especial interest to industry, educators, and the reserve forces. Officers and civilians prominent in these areas led the discussions.

• Further "family business" saw Convention delegates from throughout the country elect Thos. F. Stack, prominent San Francisco attorney and long-time AFA leader, the new President of the Association. Mr. Stack succeeds Howard T. Markey of Chicago in the post. Mr. Stack, who led organization of AFA in the San Francisco area after the war, was chosen at the head of a slate of national officers, Regional Vice Presidents, and National Directors.

The Convention centered in the Civic Auditorium in the heart of downtown San Francisco. The Aerospace Panorama display was set up in the street in front of the auditorium and in the two main halls inside.

The outdoor exhibit temporarily contributed to the city's skyline. Towering above surrounding buildings, including the familiar old San Francisco City Hall, were a ninety-five-foot-tall USAF Titan ICBM and a sixty-two-foot Thor-Able elongated by a space capsule on its nose. On show along with these were a North American X-15 rocket plane, a Bell X-1B rocket plane, and a North American Hound Dog air-launched standoff missile.

USAF's Minuteman, the second-generation mobile ICBM, joined this array of aerospace hardware in an official unveiling ceremony late Thursday afternoon, on the first full day of the Convention. Before a sizable crowd, and with an Air Force band accompaniment of "Off we go . . .," General White pressed a button erecting the missile in a launcher.

The Chief of Staff placed the ceremony in perspective in a brief talk. He noted that Minuteman, with its solid propellant, its ease of handling, and its ready mobility, represented a great step forward for the

See next month's AIR FORCE/SPACE DIGEST for coverage of additional Convention activities—the Industry Seminar, the Aerospace Educators' meetings, the "Military Mission in Space" Symposium, plus the speeches of Air Force Secretary Sharp, USAF Chief of Staff General White, and Dr. Simon Ramo.

free-world deterrent arsenal. In addition, in obvious reference to the "minimum-deterrence" concept, he observed that only if our arsenal were kept strong enough to defeat a potential enemy could it be considered a true deterrent.

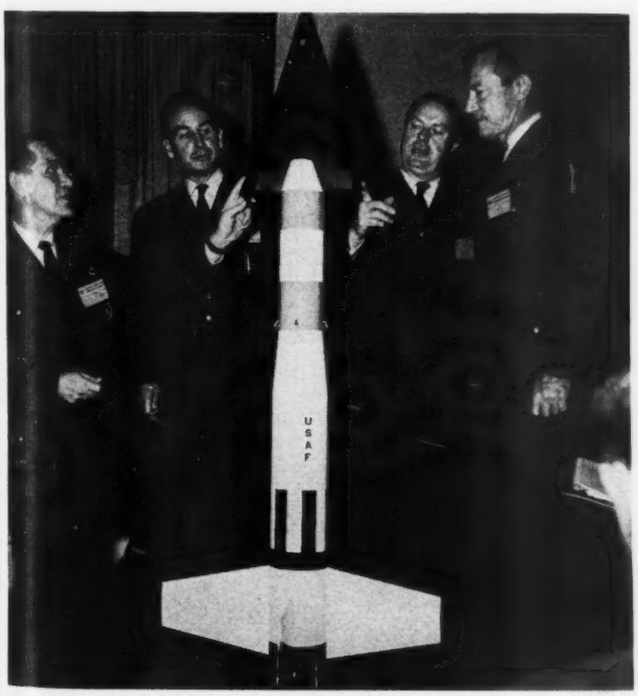
In another short talk, San Francisco Mayor George Christopher welcomed the Convention to San Francisco and said he was proud that the city was the scene of the first official unveiling of the important Minuteman. AFA President Howard T. Markey replied briefly. NBC television producer Roy Neal presided over the ceremony, commenting aptly that Minuteman's attributes will give the United States a true "push-button war capability with the purpose of preventing an aggressor from attacking for fear of how we can strike back instantly."

Altogether, the Aerospace Panorama numbered 197 exhibitors. The industry members of the Air Force-industry defense team put on display the fantastically diverse elements of hardware that play key roles in national security. A walk through the Panorama provided an education in defense today.

It was primarily to "minimum deterrence" that Convention delegates addressed themselves in the annual AFA Statement of Policy (*see pages 6 and 7 for full text*).

"The minimum-deterrence theory," the Statement declared, "holds that the threat of destruction of Communist cities and their populations is enough to deter aggressive military activities of the Soviet bloc." The fact is, AFA said, minimum-deterrence adherents believe "it is possible to deter war with forces that are not strong enough to win a war should it come."

"The Association believes that true deterrence can be achieved only with forces designed to fight and win against the forces of the enemy—a counterforce posture," the Statement asserted.



Top Air Force commanders met with newsmen at a series of press briefings at Convention. Here Headquarters USAF briefing officers—Lt. Gen. Roscoe C. Wilson, Brig. Gen. Richard D. Curtin, Brig. Gen. Robert C. Richardson, and Brig. Gen. Noel F. Parrish—unveil a model of Dyna-Soar.

The Statement also called once more for a single military service, an across-the-board national effort in the cold war, and added support for vital aerospace programs.

The specifics of programs, plans, and requirements in the current Air Force were spelled out for the press and other Convention participants free to take part in a series of major command briefings. Headquarters USAF, the Strategic Air Command, the Military Air

(Continued on following page)

JOINT STATEMENT ON DEFENSE OBJECTIVES

The Presidents of the Air Force Association, the Association of the US Army, and the Navy League issued the following joint statement on September 23, 1960, at the AFA Convention in San Francisco, in support of mutual objectives for the strengthening of national security. These objectives, developed over a period of the past several months, were approved by the governing bodies of all three Associations. The statement represents the first formal and combined effort of the three major service organizations to highlight mutual objectives, although elements of them have been espoused by all three Associations individually in the past.

* * *

1. While recognizing that the total threat of aggressive communism covers a wide spectrum, we believe that the military threat continues to be the basic consideration.

2. To ensure free-world security, the military forces of the free world must be capable of deterring, repelling, or defeating attack from any nation or combination of nations.

3. An adequate military posture must be measured against the threat it is designed to meet and not against an arbitrary fiscal ceiling. The American people under the free-enterprise system can support whatever level of patriotic effort and expenditures is needed to defend their freedom.

4. National complacency concerning the Communist threat and our ability to counter it is an internal enemy that deserves the full attention of all areas of our leadership.

5. The status of the professional military man deserves continuing review to assure that basic requirements of life, such as pay and housing, are maintained at levels commensurate with his unusual responsibilities and sacrifices.

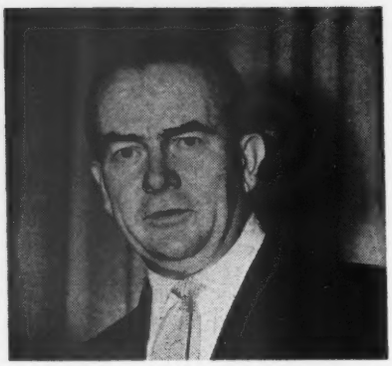
6. The ability of our population to survive surprise attack through protective measures must be provided for as a necessary element of our national deterrent posture.

(signed)

HOWARD T. MARKEY
President, Air Force Association

LT. GEN. MILTON G. BAKER, PARNG (Ret.)
President, Association of the US Army

FRANK G. JAMESON
President, The Navy League of the United States



Toastmaster supreme at Outstanding Airmen's and Aerospace Luncheons was the famed creator of "Steve Canyon," cartoonist Milton Caniff.

AIR FORCE ASSOCIATION AWARDS

AIRPOWER AWARDS

Gen. Thomas D. White, Chief of Staff, United States Air Force, "Aviation's Man of the Year"—H. H. Arnold Trophy.

Dr. Louis Ridenour, Jr. (posthumously), electronic physicist and Lockheed vice president—AFA Science Trophy.

Wayne O. Reed, United States Deputy Commissioner of Education—Hoyt S. Vandenberg Memorial Trophy.

CITATIONS OF HONOR

Lt. Gen. William E. Hall, Commander, CONAC.

Maj. Gen. Winston P. Wilson, Chief, Air National Guard.

Maj. Gen. Arno H. Luehman, USAF Director of Information.

Col. Carlo R. Tosti, Special Assistant to the DCS/Development.

Ken Ellington, Republic Aviation.

Dr. Charles H. Boehm, Pennsylvania Superintendent of Public Instruction.

THE PRESIDENT'S TROPHIES

O. Donald Olson, Colorado.—AFA's Man of the Year.

San Diego, Calif., Squadron—AFA's Unit of the Year.

UNIT EXCEPTIONAL SERVICE PLAQUES

Squadrons of the Utah Wing—Aerospace Education.

Anchorage, Alaska, Squadron—Membership.

Chico, Calif., Squadron—Programing.

Erie, Pa., Squadron—Community Relations.

INDIVIDUAL EXCEPTIONAL SERVICE PLAQUES

Willard L. Dougherty, Hartsdale, N. Y.

Curtis J. Irwin, Syracuse, N. Y.

Joseph D. Myers, Santa Monica, Calif.

Chester A. Richardson, Pittsburgh, Pa.

Will O. Ross, Mobile, Ala.

Robert P. Stewart, Kaysville, Utah.

Donald J. Strait, Bedminster, N. J.

Ralph V. Whitener, Springfield, Va.

MEDALS OF MERIT

Joanne Affronte, Long Beach, Calif.

Robert F. Brooks, Pasadena, Calif.

John L. Beringer, Jr., Pasadena, Calif.

G. Reid Doster, Jr., Birmingham, Ala.

H. Bentley Hahn, Baltimore, Md.

Ruth E. Young, Pittsburgh, Pa.

SPECIAL AFA CITATIONS

Thomas G. Lanphier, Jr.
Chas. O. Morgan, Jr.
Maj. D. B. O'Hara, USAF.
Col. Roy E. Cooper, ANG.
Lt. Col. R. F. Knight, ANG.
1st Lt. D. J. Hendry, ANG.

AFA-AMC MANAGEMENT AWARDS

Maj. Gen. Frank A. Bogart—Distinguished Management Award.

Col. Loran J. Anderson—General Management Award.

Col. Glover P. Grubaugh—Maintenance Engineering Management Award.

Joseph E. Mileur, Jr.—Supply Management Award.

Col. Louis H. Garrett—Procurement and Production Management Award.

RESERVE FORCES AWARDS

Maj. Milan R. Forkapa, Jr., Toledo, Ohio — Earl T. Ricks Memorial Trophy.

445th Troop Carrier Wing, Robins AFB, Ga.—Outstanding Air Reserve Unit.

141st Tactical Fighter Squadron, McGuire AFB, N. J., and **163d Tactical Fighter Squadron,** Fort Wayne, Ind.—Outstanding Air National Guard Unit.

MSgt. Francis E. Nowicki, Willow Grove, Pa.—Outstanding Air Reserve Airman.

SSgt. Clarence E. Cunningham, Charleston, W. Va.—Outstanding ANG Airman.

Transport Service, the North American Air Defense Command, the Air Research and Development Command, and the Tactical Air Command held briefings. Newsmen from throughout the country and abroad, 403 of whom registered at the Convention, heard and questioned an all-star team at these affairs.

Presenting air staff views at the Headquarters USAF session were Lt. Gen. Roscoe C. Wilson, Deputy Chief of Staff, Development; Brig. Gen. Richard D. Curtin, then Deputy Director of Systems Development, DCS/Development; Brig. Gen. Noel F. Parrish, Assistant for Coordination, DCS/Plans and Programs; and Brig. Gen. Robert C. Richardson, III, Chief, Long-Range Objectives Group, DCS/Plans and Programs.

Other briefing officers were Maj. Gen. David Wade, Commander of SAC's 1st Missile Division, Vandenberg AFB, Calif., for SAC; MATS Commander Lt. Gen. Joe W. Kelly; NORAD Commander in Chief Gen. Laurence S. Kuter; ARDC Commander Lt. Gen. Bernard A. Schriever; and TAC Commander Gen. Frank F. Everest.

The Convention's major addresses came from General White at the Aerospace Luncheon event and Secretary of the Air Force Dudley Sharp at the Awards Banquet.

General White warned yet again that the free world will be secure only so long as it is physically and decisively stronger than the Communist bloc. Stressing the need for continuing buildup of "decisive military power," he said:

"I for one am absolutely convinced that the Communist bloc will use whatever avenue is most open to their goal of world domination—political, economic, or military. . . .

(Continued on page 44)

Chief of Staff, Gen. Thomas D. White, left, beams after receiving H. H. Arnold Trophy, presented by Mrs. H. H. Arnold. Right, Maj. Gen. Benjamin D. Foulois, USAF (Ret.).

Mrs. Louis Ridenour, Jr., widow of late, great US defense scientist, accepts Science Trophy awarded posthumously to her husband. Outgoing AFA President Howard T. Markey makes the presentation.

DETERRENCE ON DISPLAY — CONTINUED

AFA's outgoing President, Howard T. Markey, presents Vandenberg Trophy for many educational contributions to prominent educator Wayne O. Reed.

Emcee Milton Caniff does the honors as CONAC Commander Lt. Gen. William E. Hall receives an AFA Citation of Honor for reserve forces leadership.

Citation of Honor goes to the Chief of the Air National Guard, Maj. Gen. Winston P. Wilson, for leadership in bringing ANG to peak of readiness.

Maj. Gen. Arno H. Luehman, Director of Information of the Air Force, is presented with a Citation of Honor for his role in telling USAF's story.

Col. Carlo R. Tosti, Special Assistant to DCS/Development, accepts a Citation of Honor for contributions to space-age education across the US.

Ken Ellington of Republic Aviation is honored with Citation of Honor in recognition of continuing efforts on behalf of progress in aerospace.

An AFA Citation of Honor goes to Dr. Charles H. Boehm, Superintendent of Public Instruction in Pennsylvania, for instituting new aerospace courses.

O. Donald Olson of Colorado Springs, Colo., is named AFA's Man of the Year in Awards Banquet ceremony for his long list of Association activities.

AFA's San Diego, Calif., Squadron was chosen Association's Unit of the Year. Squadron Commander Walter L. Jones accepts award from Mr. Markey.

This crowded scene is at the Awards Banquet, which climaxed the Convention and saw recognition, through awards and public introductions, of many aerospace notables.

USAF's ace parachutist, Capt. Joe Kittinger, chats at Awards Banquet with record-breaking aviatrix Jerrie Cobb, left, and Tiny Broadwick, an early woman parachutist.

"Allied nations must prepare and maintain the military strength to accomplish the overriding task—the task of destroying the military strength of the Communist bloc—if war is forced upon us," he said.

"And in this task no single weapon or type of weapon can accomplish the job. Nor does one service or one nation stand alone. We need complementary weapons on land, at sea, and in aerospace—a combination of forces designed specifically to provide the free world with the varied capabilities it requires."

Secretary Sharp, focusing attention mainly on a comparison between US and Soviet armed strength at present and in the future, declared that aerospace was the decisive arena in the struggle for world power.

General Foulois held Awards Banquet audience spellbound with an impromptu speech on the vital need for US preparedness in an age of increasing peril. The crowd gave the General a rousing standing ovation.

"All scientific developments today point to the predominance of aerospace in the weapons needs of tomorrow," he said. "We will go through phases of launching them from different platforms and controlling them differently, but in the long run aerospace is the dominant medium today, and it will be tomorrow.

"The Air Force has no intention of setting its sights on anything less than a force that will be powerfully decisive," he continued, hammering at minimum deterrence. "We must be prepared to win should deterrence fail. There is no safe alternative now or in the future. In line with this intent, the Air Force will continue to think in terms of a blend of manned and unmanned weapon systems. We can never consider that it is a matter of either missiles or bombers, since both have their specific applications."

The Awards Banquet at which Secretary Sharp spoke provided a program rich in the history of man's ventures and attainments in the field of flight. General White received the H. H. Arnold Trophy as Aviation's Man of the Year at this event. General Arnold's widow, Convention Honorary Chairman, made the presentation.

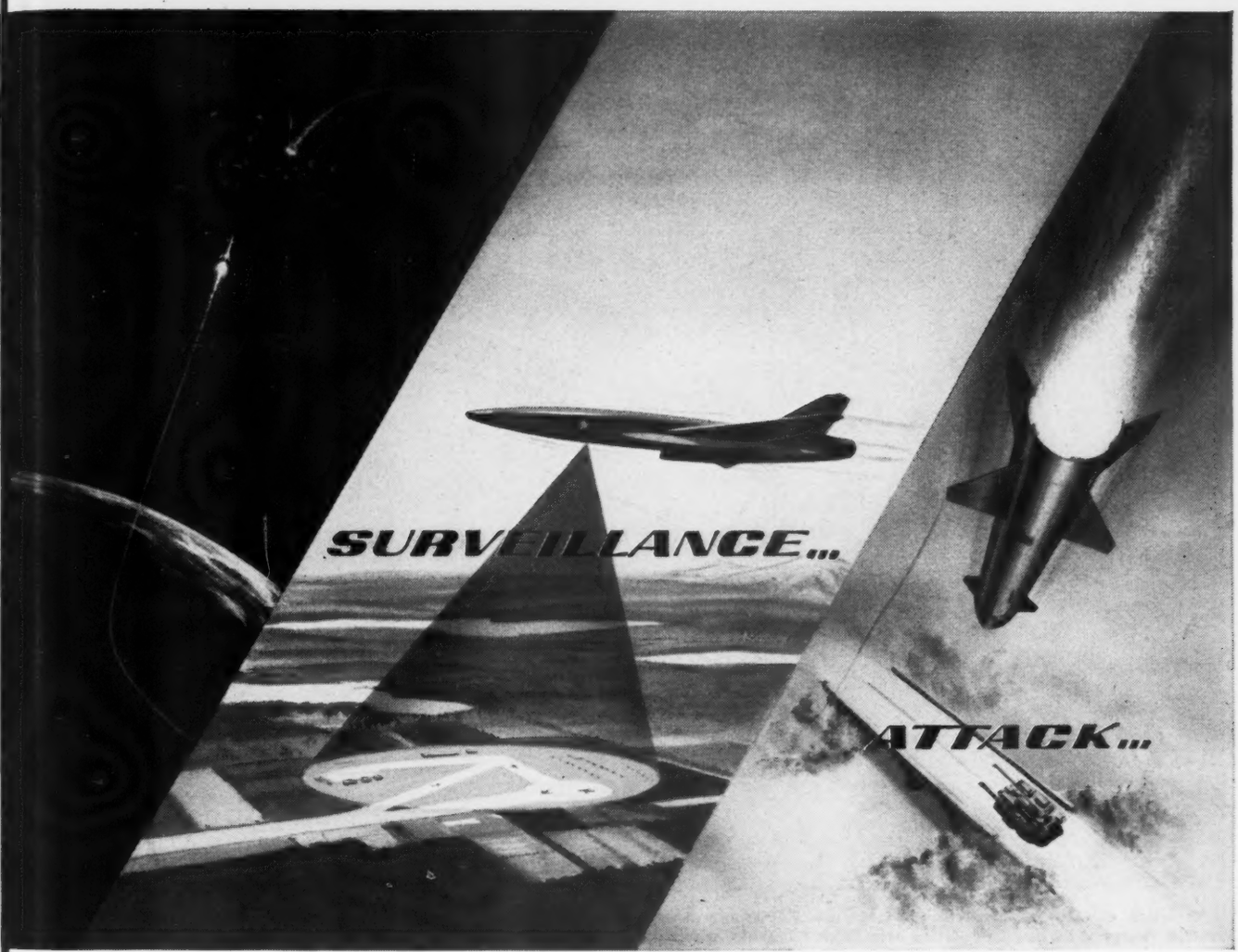
But it was in President Markey's verbal review of US flight history, and his introduction of persons as he went along, that the full flavor of the occasion lay. Sprinkled through the audience were numerous men and women of aerospace distinction. Most of them did not know they were to be introduced.

One by one, the spotlight and the speaker picked them out: Early Birds, men who flew before the first war. Pioneer airmail pilots. One of the first woman parachutists. General Foulois, who at one point in the early days was the nation's only flying officer. The country's aerial aces, including Colonel Gabreski, who met in San Francisco in conjunction with the Convention to form the Fighter Aces Association. Congressional Medal of Honor winners, including Jimmy Doolittle. There were more, many more. The audience applauded long and hard as the spotlight made its frequent stops throughout the banquet room.

Then the present. Maj. Bob White, the USAF X-15 pilot who set a new manned aircraft record of 136,500 feet on August 15. Capt. Joe Kittinger, who made aerial history parachuting a record 103,000 feet from an open balloon gondola over New Mexico on August 16. Captain Mitchell, the Discoverer XIV catch-plane pilot, who performed that feat on August 19. TSgt Louis F. Bannick, winch operator aboard the Flying Boxcar that made the catch, who thus qualified as the world's first "space fisherman." Capt. William D. Habluetzel and Lt. John J. Hargreaves, who spent thirty days in a space-cabin simulator as part of USAF man-in-space work. They emerged in mid-September. The Air Force's twenty "outstanding airmen" of 1960, Convention guests of AFA who were honored also at a luncheon the following day.

And so it went. General Foulois, when he was introduced, gave an impromptu talk on national preparedness.

(Continued on page 120)



WEAPON SYSTEMS BY REPUBLIC'S MISSILE SYSTEMS DIVISION

Bridging the scientific and technical gap between military necessity and tested, proved, reliable weapon systems is the task of Republic's Missile Systems Division. Our scientists and engineers plan, direct, and supervise projects from conception to operational hardware... through systems synthesis and analysis, research and development, prototype fabrication, test, and production. ➢➢➢ Republic designs and builds completely integrated systems for performing vital defense functions.

Present programs include work in:

- **Air/Space Vehicles**
- **Guidance and Control Systems**
- **Infrared, Radar and Photographic Sensors**
- **Data Processing and Display Equipment**
- **Ground Support Equipment**
- **Secure Communications Links**
- **Nuclear Weapons Phenomenology**

REPUBLIC AVIATION

MISSILE SYSTEMS DIVISION

MINEOLA, LONG ISLAND, N. Y.

Russia, in the past, has been no great shakes at the design of transport aircraft. Soviet efforts to sell planes on the world market have in consequence proved a general failure. Today, however, in the IL-18 Moscow turboprop, the Russians appear to have developed a worthy vehicle to bear their . . .

The lines of the IL-18, shown here at Paris Air Show of 1959, are cleaner than those of TU-104 jet transport. Radar scanner in nose provides storm and terrain warning, ground mapping, picks up ground beacons to help navigation.

RED FLAG ALONG THE

A RED AIRPOWER FEATURE

SINCE World War II the Soviet Union has made continuing bids to sell air transports on the world market. However, with the exception of the satellite powers, few prospective buyers have been interested. Transports designed and built in Russia have not been competitive with those produced in the US, Great Britain, and France in terms of operating efficiency, comfort, and reliability. They have been priced lower, but still they have not sold.

Now, however, the Russians appear to have come up with a plane that is at least competitive. It is the medium-range IL-18 turboprop, which in many ways resembles the Lockheed Electra.

The plane is currently in fairly extensive service. Aeroflot, the Soviet state airline, uses it on domestic routes. Behind the Iron Curtain, the IL-18 has been bought by Czechoslovakia's CSA, Poland's LOT, Hungary's Malev, and East Germany's Interflug airlines. The Red Chinese CAAC line is buying some, as is Ghana.

In addition, Egypt, the Congo, Indonesia, Yugoslavia, and Cuba are considered likely customers.

The IL-18 looked good in the Congo, where the Russians and Czechs provided ten of the planes that carried UN troops into the country. They also hauled in Soviet technicians and Czech supplies and ferried Congolese troops in the service of crisis Premier Patrice Lumumba.

At this writing, the IL-18 had been grounded by Aeroflot following an in-flight explosion of one aircraft near Kiev. This was the first reported major accident the IL-18 had suffered in more than two years.

The plane, through this period, displayed one notable weakness. It is said to have a bad vibration char-

acteristic. Russian officials say steps have been taken in this regard.

The first IL-18 was displayed publicly at Moscow's Vnukovo Airport three years ago, on July 10, 1957. Early IL-18s were equipped with the 4,000-hp Kuznetsov NK-4 turboprop engine. This engine may have caused some of the IL-18's early troubles. Foreign observers passing through Vnukovo reported seeing an IL-18 roped off on the ramp, with one engine off and the wing black with soot as if there had been a fire.

In any event, after the first dozen were equipped alternately with the NK-4 engine and the equally powerful Ivchenko AI-20, the latter engine was selected for all future IL-18s and for the AN-10, another four-engine turboprop transport then under development.

The Russians reported glowingly on IL-18 performance when it completed a 10,662-mile flight in 27.5 hours, at an average speed of 388 mph, on March 21 and 22, 1958. The airplane was flown from Moscow to Petropavlovsk on the Kamchatka Peninsula, then over the polar ice to a Soviet scientific station on the ice cap, thence past a Soviet air base on the rim of the Arctic Ocean, and finally back to Moscow.

Later in 1958 the aircraft won a gold medal at the Brussels World's Fair, and at the end of the year the Russians used the airplane to make pretty much a clean sweep of important FAI payload-speed-altitude records for propeller-driven aircraft.

Shakedown runs then were made over a period of months between Moscow and the Ukraine during which the IL-18 carried freight and mail. On April 20, 1959, the IL-18 "Moscow" (NATO code-named Coot) went into regular passenger service. Today it plays a major part in Aeroflot scheduling.

Designer Sergei Ilyushin and his crew shared a Lenin prize for design and development of the IL-18. They also showed themselves to have been careful students of aircraft design in the West. The IL-18 is the closest the Russians have come to a "Western" aircraft. Gone is the hand-made lace found in the TU-104 jet. The overhead racks are solid instead of being made of fish-net that sways with its cargo as the airplane shifts about. Cabin pressurization has been standardized so that cigarettes burn well even at 30,000 feet. The airplane has a seat belt for every seat, an unusual Russian concession to the safety-minded West. Air inside the cabin is changed every two minutes, as in US planes. IL-18 soundproofing is exceptional by Russian standards.

Construction features of the IL-18 are quite conventional. The fuselage is lightweight, semimonocoque in circular section, with an external diameter of 11.5 feet. No honeycomb structural materials have been used, but all vital areas, including windows and doors, say the Russians, have duplicate structural members. Wingspan is 122 feet, 8½ inches; length, 117 feet, 9 inches; height, 33 feet, 4 inches; landing gear are of the tricycle type.

The inner wing panels, which extend well past the outboard engine, are three-spar affairs. The outer panels have two spars. All available wing space is used to carry fuel, with standard flexible cells between the spars of the inner panel. Integral tanks are used in the

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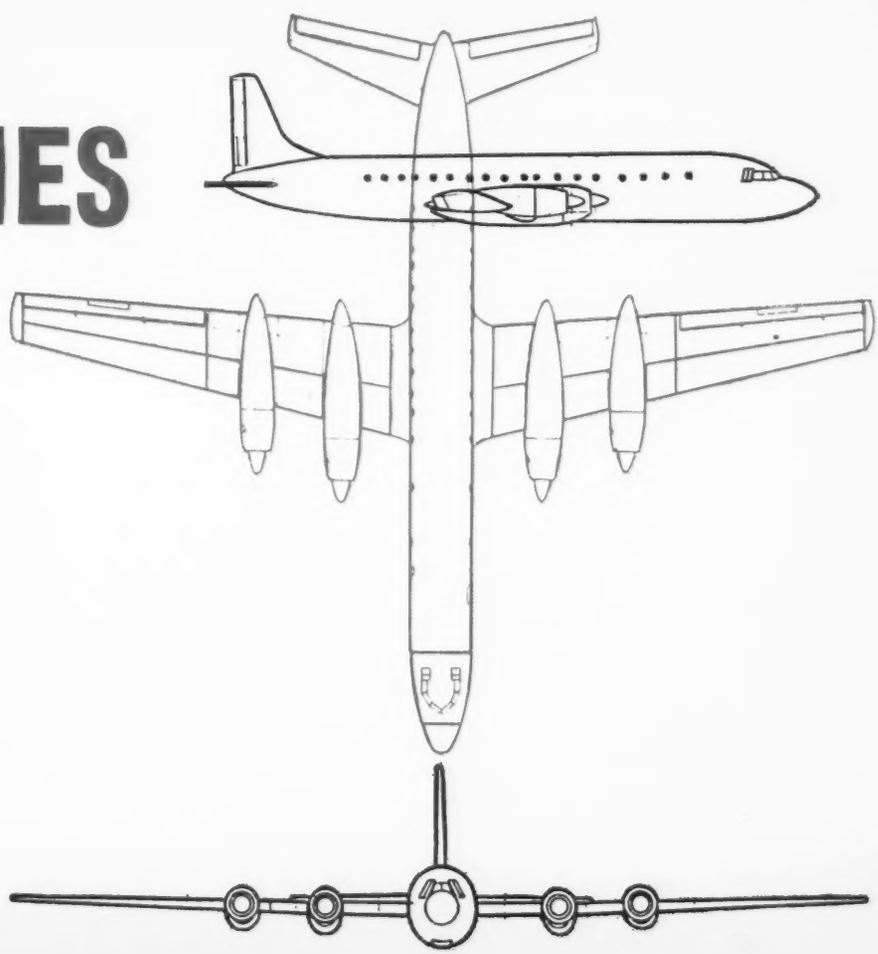
AIR LANES



NATO code-name: Coot
Russian name: Moscow
Designer: Sergei Ilyushin

Dimensions:
Span: 122 ft., 8½ inches.
Length: 117 ft., 9 inches.
Height: 33 ft., 4 inches.
Wing area: 1,507 sq. ft.
Wing chord at root: 18 ft., 5 inches.
Wing chord at tip: 6 ft., 2 inches.
Wing aspect ratio: 10.

Weights:
Maximum takeoff: 135,584 lb.
Maximum payload: 30,865 lb.
Maximum wing loading: 89.1 lb. per sq. ft.
Maximum power loading: 8.38 lb. per equiv. shaft hp.

Performance:
Cruise @ 26,000 ft.: 388-404 mph.
Range, absolute: 3,480 miles.
Takeoff run, empty: 2,625 ft.
Takeoff run, loaded: 3,940 ft.
Landing run: 1,970 to 2,300 ft.

outer panel. Total fuel capacity for the IL-18 is given as 6,100 gallons, but for hops of 1,800 miles or less the fuel load usually is held to 4,720 gallons so more freight can be carried.

Fueling normally is accomplished by connecting pressure hoses to international-type connections provided through inner wheel nacelles. There are two on each side. Otherwise, fueling may be carried out by gravity feed through six caps atop the wings.

The four Ivchenko AI-20 engines have ten-stage axial compressors and three-stage turbines. They are single-spool, with the planetary reduction gear (ratio, 0.087:1) mounted forward inside the air intake. There are ten burners in the annular combustion chamber.

The engines are operated at relatively low temperatures, like all Russian turbine engines insofar as is known. At all altitudes and conditions, the maximum temperature allowed past the turbine is 968 degrees. Engine speed during takeoff is 12,300 rpm, plus or minus ninety rpm. During flight the speed is reduced to 10,400 rpm, plus or minus 200. Specific fuel consumption is estimated at 0.38 pounds per equivalent shaft horsepower.

The engine has rubber mounts, with tie bolts on each side of the engine casing and a third at the rear. A complete power plant can be removed as a unit, a feature that long has characterized Ilyushin designs.

Titanium is used rather freely in the IL-18. Firewalls around the engine are made of titanium, and the jetpipes behind the engine employ the metal. The wing is protected from engine hot parts by air ducts of titanium, which makes for good cooling of structural elements.

The Russians say they don't believe in hot-air deicing systems which draw on turboprop engines, but they do employ such systems on their turbojet-powered aircraft. They fear the bleeding off of hot air from a turboprop might cause too great a reduction in power. For that reason, if for no other, the IL-18 has a large electrical system so that deicing of the leading edges of the wing and the vertical and horizontal stabilizers can be done electrically. The electro-thermal unit consists of an insulated, sandwich-type thermal structure between two metal skins. About one-tenth of the wing chord is protected by this deicing system; a somewhat smaller proportion of the stabilizers is protected. A similar system is used on the propellers, giving them protection over a little more than half the length of each blade along the leading edge. The windshields are laminated, with a film between that can carry electrical energy and provide heat for deicing.

When the IL-18 was shown at the Paris Air Show in 1959, its sleek lines and interior accommodations were greatly admired. Many countries are buying the new turboprop.

Though the cockpit is unsophisticated in many respects, it is neat, logical, and quite roomy. Both pilot and copilot have blind flying instruments, radar, and ILS indicators. Data on the engines, hydraulic system, and pressurization are presented on a central panel between the pilots, with radio and electronic controls immediately above. The roof of the cockpit carries the radio compass, a fire-extinguishing control, and a variety of other switches. Engine controls, as well as trim tabs, flaps, landing gear, and autopilot are all on a pedestal between the two positions.

The navigator sits behind the chief pilot, facing the outer wall of the airplane. The radio operator sits behind the copilot in a similar position to the navigator and back to back with him. There is room for a flight engineer between the navigator and radio operator, but he rarely is used in practice.

The IL-18 has a far greater margin for safety than do most aircraft built in the USSR. It is not underpowered, as are some of its sister, pure-jet aircraft, such as the TU-104. It can fly well on three engines if necessary. It is interesting that the airplane's cockpit has an airtight bulkhead between it and the passenger cabin so that the loss of pressure in one need not affect the other. Basic radio and navigation equipment is duplicated in the aircraft.

Passengers board the airplane through both front and rear doors that are about four and a half feet high and two and a half feet wide. Since the aircraft has three compartments inside, it can carry three classes of passengers with ease. All seats are mounted on rails so the seating arrangement can be changed at will. The forward cabin will take twenty to twenty-four passengers, depending upon the desired density of seating; the main cabin will take fifty first-class passengers or seventy-one in coach class with six seats abreast. The rear cabin can take fourteen to sixteen tourists seated five abreast, or a special luxury class, with reclining slumber chairs and seating no more than eight. Seating arrangements may be for as few as seventy-three to as many as 111 passengers. The aircraft also can be purchased in a luxury "executive" version. The maximum cabin width is ten feet, seven inches.

The performance of the IL-18 is generally given out quite freely by the Russians, who of course seek to find foreign markets for the IL-18. However, daily, hourly, or per-mile operation costs are not revealed. Apparently there are a number of different purchase prices for the airplane, in line with Red policy of altering price for political reasons. One figure reported is $1.5 million, which would put the plane in the early DC-7 class and far below the Lockheed Electra in this regard.

Although there are enough performance, maintenance, and preference problems to keep the IL-18 from becoming a latter-day DC-8, it is a long step forward.—END

With national security at stake... missile base contractors fly

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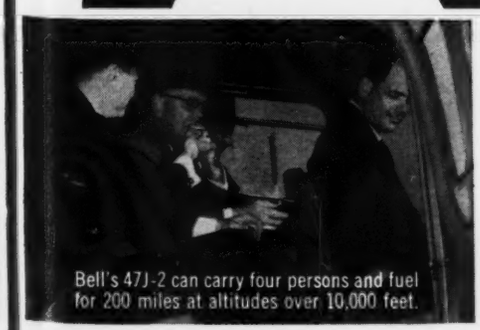

Bell's 47J-2 can carry four persons and fuel for 200 miles at altitudes over 10,000 feet.

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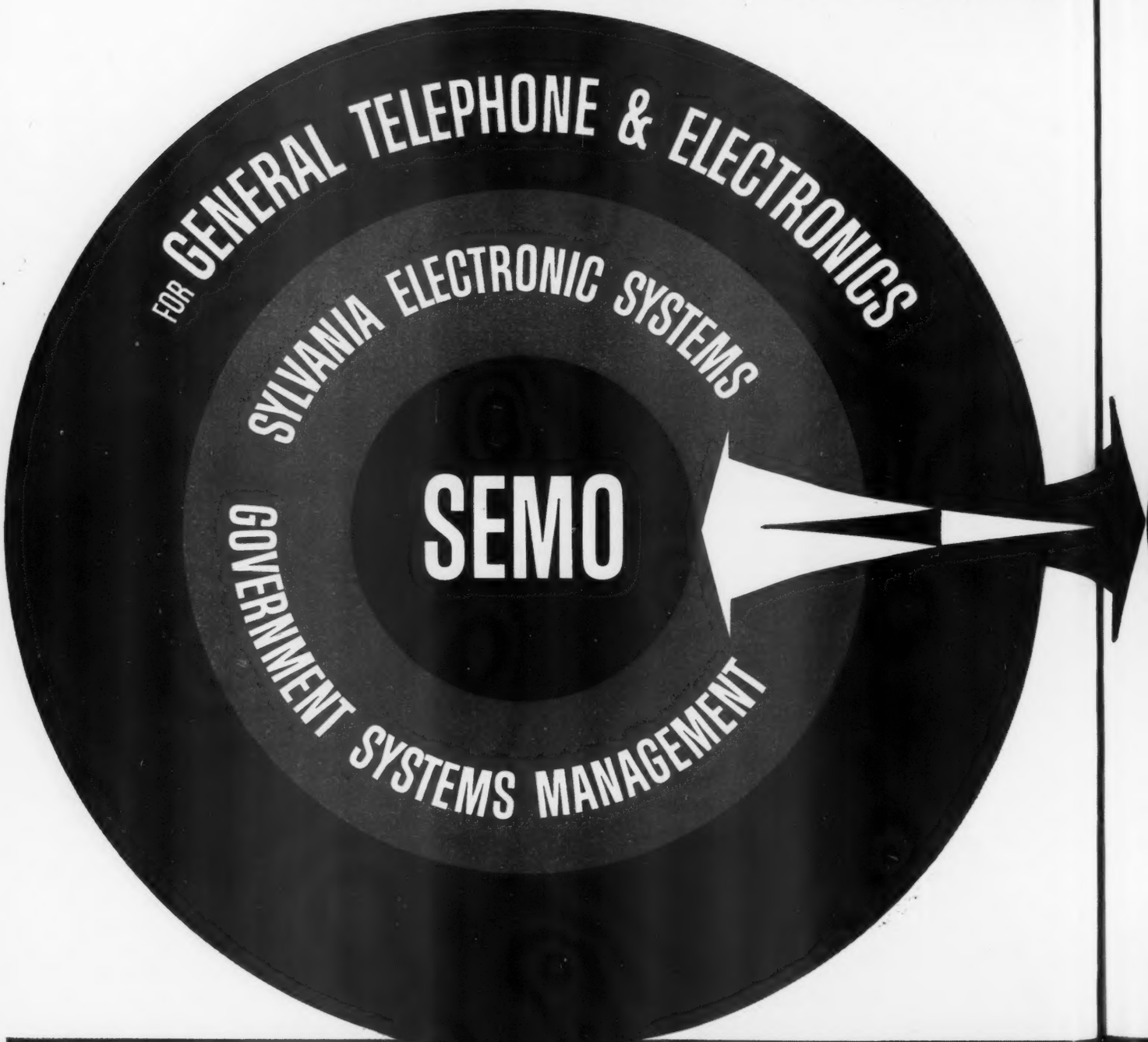

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FOUR paintings on an auditorium wall tell the story of an increasingly important armed forces school.

In the first, a symbolic treatment of modern aerospace power, a ballistic missile blasts off in a burst of flame and a jet bomber flashes toward target. The second depicts a Marine amphibious landing in the South Pacific in World War II. Army troops on the move after a breakthrough against the Reds in Korea are shown in the third. Last, the Allies accept Japanese surrender aboard the battleship *Missouri* in Tokyo Bay after World War II as thousands of Air Force and Navy planes fly overhead.

The auditorium is located at the Armed Forces Staff College, Norfolk, Va. Here, officers at the major and lieutenant colonel levels from all the services—Air Force, Army, Navy, and Marines—learn to think unified. The experience, contained in a rigorous five-and-a-half-month curriculum of discussions, lectures, readings, presentations, problems, and field trips, prepares them for a wide range of assignments in joint and combined commands and operations.

The officer students, like the paintings in their assembly hall, concern themselves with all modes and weapons of warfare today, from total nuclear on down, as well as the economic, social, and cultural ingredients of international conditions. Mainly, however, the Armed Forces Staff College is interested in "big-picture" considerations for background and in a general sense. AFSC does not train officers so much in the actual planning of national strategy as in working effectively within staff organizations. The joint and combined schooling of senior officers for top-level planning falls within the realm of the National War College and the Industrial College of the Armed Forces—the other two major joint schools within the US armed forces framework.

"Here at the Armed Forces Staff College, field-grade officers of all the services learn to use the tools of organization together," explains Air Force Brig. Gen. Harold L. Neely, AFSC Deputy Commandant. "This is a school for Indians, not chiefs, and here the Indians learn effective joint staff work."

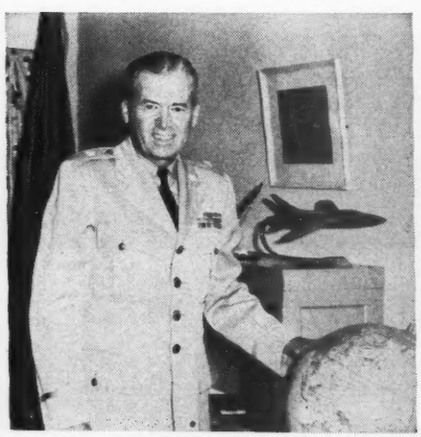
Issues of armed forces organization, including the single great issue of unification, are also outside the main burden of course matter at the school. But the mission of the school causes it to deal directly in the working relationships of the different services, and therefore in the roles, missions, capabilities, and limitations of each. Thus what might be termed "service viewpoints" on these subjects are a major underlying factor in the school's operations.

Without taking any position on such issues as single service, the Armed Forces Staff College, by its very existence and the fact that its graduates are in greater demand each year, speaks volumes on the need for a truly unified approach to military problems today. It also makes what it feels to be a major contribution toward genuine unification in the training it affords students.

"No one service can consider itself the only service," declares an Air Force general on the staff of the Armed Forces Staff College at Norfolk, Va. Here field-grade officers of all the armed services spend five and a half months . . .

LEARNING TO

Frederic M. Philips
ASSOCIATE EDITOR



USAF Brig. Gen. Harold L. Neely, one of three Deputy Commandants of the Armed Forces Staff College, in his office at Norfolk, Va., school.

Guest lecturer addresses students in institution's auditorium. Discussions, seminars, lectures, field trips, problem assignments comprise bulk of the course material for students of all the services. In existence since 1947, college has graduated 5,000 officers. Demand for graduates is ever-increasing.

General Neely puts it this way:

"In his time here, the individual's whole concept and approach changes. When he comes here he may be, shall we say, overimbued with his particular service's views and beliefs. He leaves at the end of the course with a much broader feel for our whole military position, for the capabilities and limitations of each service.

"The great need these days is for a high level of cooperation, of integration, among the services and among the allied nations of the free world. This school contributes immensely toward a working level understanding along these lines. Our underlying precept is that no one service can consider itself the only service, that we must *all* work together—and we must know how to do it day to day at the planning and working levels.

"Naturally, we don't know what form the next war will take. We devoutly hope there will not be one. If there is, it could be a nuclear holocaust, it could be Korean-type, or we could actually witness a long-term peripheral nibbling-away by the Communists. In any event, there is no question that we must be prepared to meet the threat whatever form it takes, and each service has its part to play.

"That, I think, is the philosophy that our students take away with them, along with improved ability to perform assignments in joint and combined staff work."

The Armed Forces Staff College dates to a proposal by Gen. H. H. Arnold, then Commanding General, Army Air Forces, in 1942. As a result of his call for an institution to provide Army and Navy officers with instruction in joint planning, the Army-Navy Staff College was established in Washington in 1943.

This school, considered highly successful, was redesignated the National War College in 1946. Later that year, to fill the educational gap thus left at the staff level, the Armed Forces Staff College was created at Norfolk. Since the first class entered in February 1947, some 5,000 officers have graduated from the school. At present, there are about 200 to a class, including a handful of civilians representing government agencies and officers of allied nations.

Its broad aims, today as when the college came into being, are listed as these:

- To promote teamwork among the services.
- To educate selected officers in the organization, planning, and conduct of joint and combined operations.
- To prepare officers for duty in the higher echelons of the armed forces.
- To promote the development of understanding between higher echelons of the armed forces and those other agencies of the government which contribute to national security, and to provide an appreciation of the related aspects of national and international security.

The college presents an ambitious and diverse course to achieve these aims. The curriculum is divided into four phases.

(Continued on following page)

THINK UNIFIED

Administration building of the Staff College, which is housed in former Navy buildings on the outskirts of Norfolk's giant Naval Operating Base.

In the first phase, guest and faculty lecturers present a series of talks on the National Defense System. These are designed to provide a grasp of the organization and functions of the Department of Defense, the Department of State, and the national intelligence agencies. Also covered are some of the more important programs conducted by DoD—guided missiles, nuclear weapons, studies of physiological and psychological factors connected with nuclear weaponry.

Phase II, Armed Forces Orientation, is devoted to providing an understanding of the limitations and capabilities of each of the armed forces. One full week is devoted to group study of each of the services. Here students themselves act as instructors on their own services. Lectures, some of them by high officers in the particular service under examination, supplement group study of the service's mission and approach to its mission.

Also supplementing classroom work in this connection are a series of field trips that make each student familiar with a variety of weapon systems. Last semester, for example, the class spent a day and a half aboard a Navy aircraft carrier and witnessed day and night flight operations. Students spent two and a half days at the Army's Fort Benning, Ga., observing infantry and tactical air operations, and one day at Camp Lejeune, N. C., as the Marines ran through their paces. They also paid a visit to SAC Headquarters, Offutt AFB, Neb., and a number of informal calls on ships and Army and Air Force bases in the military installation-crammed Norfolk vicinity.

Phase III, the core of the course, presents advanced training in joint and combined organization, planning, and operations. After carefully studying the composition of unified commands, the students are presented with four planning problems designed to teach procedures and techniques. The first deals with "initial capability planning" in the cold war—including an intelligence estimate, a commander's estimate, and an emergency defense plan. The second calls for a plan for an air-supported amphibious assault. The third spotlights logistics in such an amphibious assault.

In each problem, the students of the different services work together as joint staffs. By the time the fourth problem, a full-blown combined campaign plan, rolls around, they are operating pretty much as an independent staff with minimal faculty guidance.

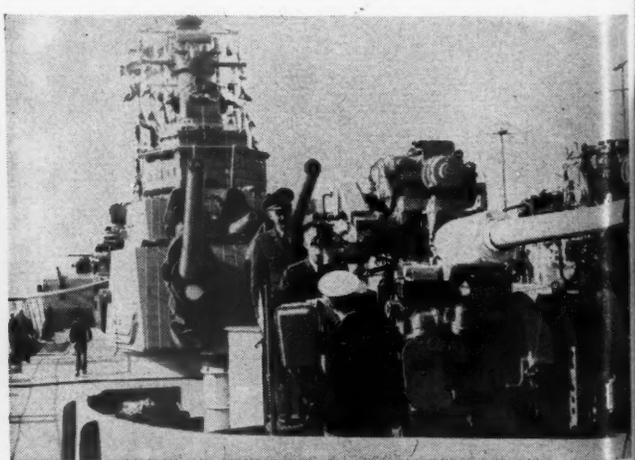
Army Maj. Gen. John S. Upham, Jr., Commandant of Staff College. Commandant position rotates among the services. General Upham's Deputy Commandants are Air Force General Neely, Navy Admiral Nation, Army Colonel Powell.

Final phase of the staff college course, Phase IV, is rich in background lectures and studies. It deals with international politics, economics, sociological and geographical factors influencing the world power struggle. Prominent lecturers speak to the students. The subjects are also taken up in discussion groups.

In harmony with its mission, the Armed Forces Staff College is itself organized as a joint command. It is headed by a Commandant, now Army Maj. Gen. John S. Upham, Jr. The post rotates among the services. Under him are three deputy commandants, one each for Air Force, Army, and Navy. These at present, in addition to General Neely, are Navy Rear Adm. William M. Nation and Army Col. Elmer R. Powell. Also on the Commandant's staff is a State Department representative whose task is to provide guidance in areas of international politics. Each service is represented equally, as well, on the college's faculty.

(Continued on page 56)

Study group of fifteen officers takes up problem at a school seminar. Informal seminar plan is used for most part in class work to allow for maximum exchange of ideas and experiences among diverse group of college students.



Students examine gun mount aboard Navy cruiser *Newport News* during field trip supplementing course work in the capabilities and limitations of three services. Other trips were to Air Force, Army, Marine Corps facilities.

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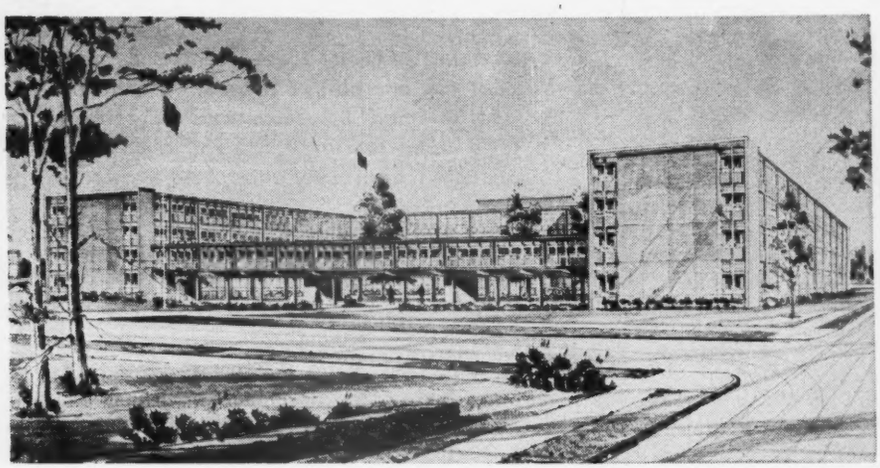


Big news at the Staff College at present is that a long-awaited new Academic Building is under construction. Left, above, architect's drawing of what the $4 million, four-floor, air-conditioned structure will look like when it is completed late next year. Right, Adm. Arleigh Burke, Chief of Naval Operations, breaks ground for the structure earlier this year. At his left is Army Maj. Gen. Thomas J. Sands, who was then Acting Commandant of the Staff College.

General Upham, who attended the college in 1948 and has served extensively with NATO since, is enthusiastic about his command. "I am proud of what we have here," he says. "It is a dynamic, forward-looking institution playing an essential role in national defense. So far as I know, there is nothing else quite like it in the world."

Currently, big news at the Staff College is that work is moving well forward on a new and long-awaited Academic Building. Since the beginning, the college has been housed in aging Navy barracks. In April of this year, Adm. Arleigh Burke, Chief of Naval Operations, broke ground for an air-conditioned, four-floor, $4 million structure that will provide the school with a physical modernity more in keeping with its dynamic role in the armed forces scheme of things. The building is scheduled for completion late next year.

The Navy is housekeeper for the school, which is adjacent to the massive naval base at Norfolk. Naval administrators supply the myriad support functions required by a community of 1,100 persons—including students, faculty, staff, assorted administrative personnel, and dependents.

Students are strongly encouraged to live on the base, a fifty-seven-acre compound, to increase personal contact and further the school's aim of fostering useful togetherness. Most of them do, with the result that the college is also the center of numerous after-hours activities from bowling league to Boy Scouts to swap shop. The living accommodations, also vestiges of the Old Navy, leave something to be desired. The hope is that these buildings too will be replaced ultimately.

Community sing among kindergarten set at college, which is center of numerous after-hours dependent activities from bowling league to Boy Scouts to swap shop. Aim is to develop community feeling, togetherness at school.

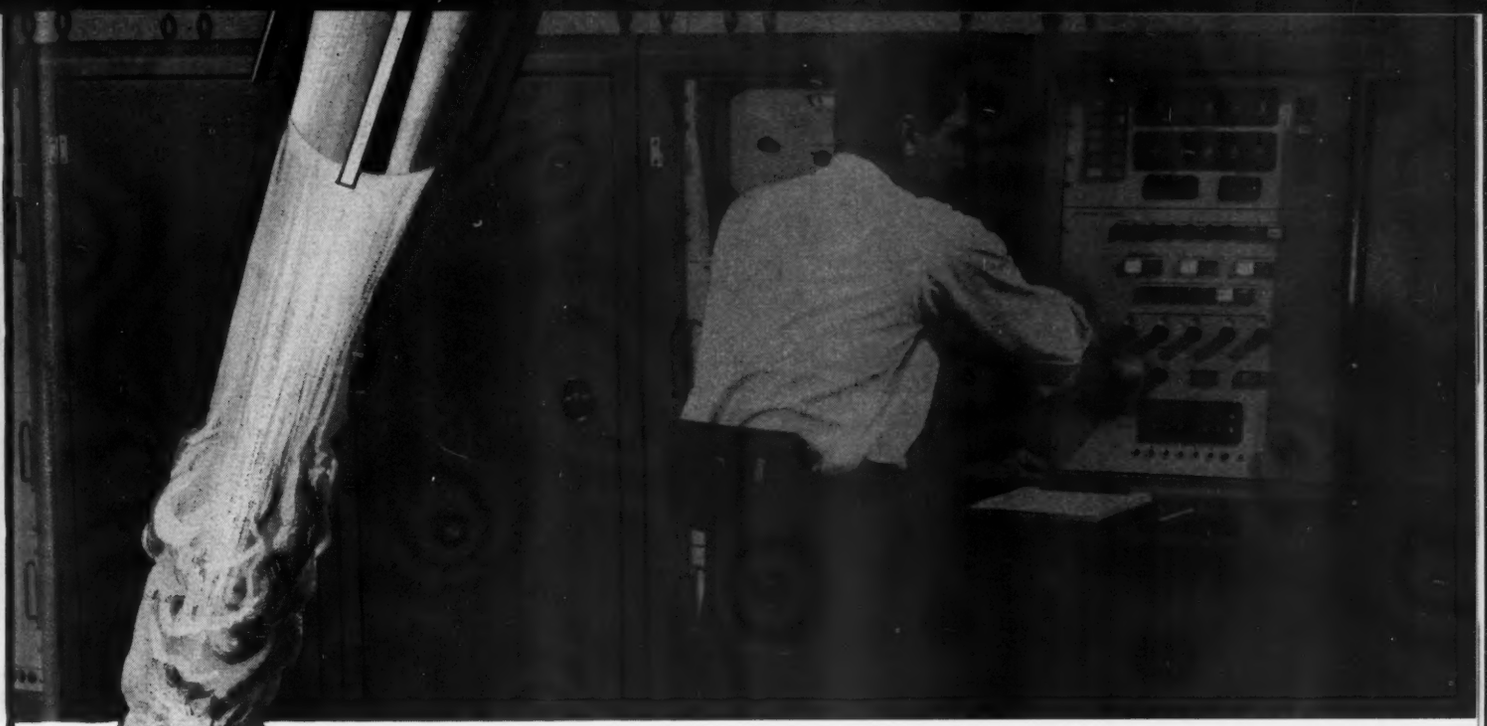
The symbolism of spanking new quarters for the Armed Forces Staff College is worth noting.

Joint and combined commands are many and increasing in number and importance. Count up just the first that occur to you and you soon run out of fingers and toes. NORAD, the Pacific Command, the Caribbean Command, the Alaskan Command, the National Security Agency, United Nations agencies, NATO, SEATO, ANZUS. The United States is a participant in forty-five defense alliances throughout the world. In recent months, two important new joint defense organizations —one-tenting, respectively, global military communications and strategic target planning—have come into being.

Under these circumstances, the requirement for officers trained in unified staff work can do little but increase. In addition, within each separate service, there is growing recognition of a need to know and work with the other services. In fact, late in 1959 the Department of Defense ruled that to be eligible for general or flag rank from then on, an officer required in his record at least one year of duty on a joint, combined, or DoD staff or an equivalent thereof. Staff and faculty of a joint college were included as such duty; a tour as a student was not.

Against this shape of events, the Armed Forces Staff College observed recently that its new building would serve as "a constant reminder of the high value our country places on the education of the leaders of our armed forces to the end of effective unification and intelligent cooperation and teamwork."

The college, completing its fourteenth academic year, plays a leading role in this vital and continuing process of education.—END



Shown above is a modified version of the AN/GJQ-9

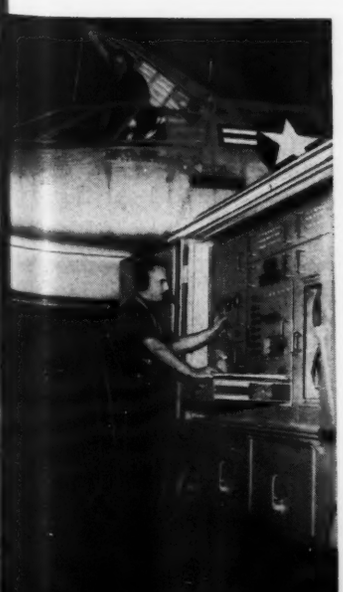
AIR FORCE SELECTS BENDIX TAPE-CONTROLLED TEST UNIT FOR SKYBOLT MISSILE CHECKOUT

The Air Force Type AN/GJQ-9 Checkout Sequence Programming Set—a universal, automatic programmer-comparator—is now in quantity production at Bendix. It is designed for automatic GO, NO-GO checkout of the GAM-87A Skybolt, an air-launched hypersonic ballistic missile manufactured by Douglas Aircraft Company. In addition, the device—capable of making as many as 100,000 test evaluations—is adaptable to a wide range of other programmed, sequential testing and monitoring operations.

Some functions of the AN/GJQ-9 are:

- **Selection of stimuli control channels for application to system under test.**
- **Regulation of program continuation in accord with measurement and evaluation results, or holding program conditions as directed by tape intelligence and selected operating mode.**
- **Operation of visual and printed read-out devices to indicate test data in accord with selected mode of operation.**

BENDIX SUPPORT EQUIPMENT—TETERBORO concentrates on developing electronic and electromechanical equipment. Systems produced besides checkout devices include adaption equipment, training devices and simulators, and monitoring equipment.



90-MINUTE CONVAIR B-58 CHECKOUT. Still another example of proved Bendix support capabilities is this flight-line computer-on-wheels. Previous flight control system checkout procedures required the time of two men for three days in making *spot* static tests. This automatic Bendix equipment makes 750 static and dynamic tests in 1½ hours. The B-58 flight control system is manufactured by Eclipse-Pioneer Division of The Bendix Corporation.

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BENDIX SUPPORT EQUIPMENT

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For the U.S. Marines—ASSIGNMENT INTERCEPT

An advanced tactical early warning radar, Sperry's extended-range MPS-21 is scheduled for adoption by the Marine Corps. The air-transportable system sets up in less than eight hours to provide concise information for control of combat interceptors.

The radar antenna searches near and far skies providing the operator with range, height, and azimuth data. Height readout is numeric, requiring no calculation. The equipment can be adapted for track-while-scan operation. Radome is a dual-wall air supported structure, compartmented so as to remain effective even when a number of the sections have been pierced.

In all, the MPS-21 is an advanced example of U. S. capability today in the critical area of tactical early warning.

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A DIALOGUE FOR STRATEGISTS

WIN, LOSE, OR DRAW?

The characters are fictitious, but the choice is not . . .

CONGRESSMAN ALFA: General, I don't understand your complaints about the Air Force budget. So far as I can see, you have enough airplanes and nuclear bombs to destroy the Soviet Union several times over. In addition, you are getting ICBMs.

COLONEL WARGAME: Congressman, don't forget that the accuracy of missiles is not exactly perfect. Neither is their reliability. Aircraft are vulnerable. Not all bombers will reach their targets, and we must send several missiles against a single target if we want to make sure it is destroyed.

CONGRESSMAN ALFA: That may be true, Colonel, but there is no need to go after each railroad station.

GENERAL BROADGAUGE: No one intends to do that.

CONGRESSMAN ALFA: Isn't the point that, under our current policies, we are not going to strike first?

CONGRESSMAN BRAVO: Well, what's wrong with that? Do you want us to start a preventive war?

GENERAL BROADGAUGE: I do not, but I think that the United States should not tie its hands. Certainly, we should not give the Soviets a guarantee that we will never strike them, even if and when our very existence is at stake. Such a strategy means that we want to commit suicide first, then rise from the ashes, overcome the victorious enemy, and ultimately win the war. I fail to see the logic in that.

CONGRESSMAN BRAVO: That sounds like preventive war to me.

GENERAL BROADGAUGE: I don't want nuclear war any more than you do. But I believe that the best way to ensure a nuclear war is to tell the Soviets that we will never strike them. We then free them from the need for constant readiness of their offensive and defensive forces. We also let them plan their armament and technical programs so as to be ready to strike us whenever they choose. Our policy of no preventive war amounts to giving the Russians an annual contribution to their military budget of roughly $10 billion.

CONGRESSMAN BRAVO: I may be dense, but I cannot understand you when you say you do not advocate preventive war.

GENERAL BROADGAUGE: Let me finish. I'm advocating first that we maintain our strategic freedom of choice. Secondly, I say that we are not, in fact, implementing our policy of no preventive war. Actually we are building a military force good only in a first-strike strategy. We refuse to pay for the strategy which we proclaim we adhere to. We are living in two worlds, and we are getting the worst part of each.

CONGRESSMAN BRAVO: Isn't deterrence our strategy rather than refusal to embark upon preventive war?

GENERAL BROADGAUGE: Precisely, and I agree with this as a national strategy. We must render the enemy unable to use his military force. Therefore, the task of the military is to win the war once it starts. Unless we are able to do this we cannot implement a national strategy of deterrence.

COLONEL WARGAME: I believe if the United States were to adopt a preventive war strategy, the Soviets might feel compelled to hit us first.

LIEUTENANT COLONEL HARDSITE: This discussion is a little out of date. Once both sides have missile forces which can be sent on their way within four or five hours, a government can decide upon war very suddenly. The Soviets have recognized this. Deciding whether we do or do not want preventive war is far less important than deciding to secure ourselves against surprise attack.

CONGRESSMAN ALFA: I was under the impression that we made this decision quite a while ago. Isn't this why we are building early-warning systems?

GENERAL BROADGAUGE: Surely. But right now warning is not reliable enough to stake our survival on it.

COLONEL WARGAME: And even if you do get warning, you may not have time enough to launch an attack before you are struck.

LIEUTENANT COLONEL HARDSITE: And once the enemy's missiles and aircraft are on their way, we are not quite sure which of his targets we should hit. Before we have retargeted our force, the enemy's atomic weapons will have struck our bases.

GENERAL BROADGAUGE: If we decide to retaliate, we will only be able to destroy some of his cities. Because he can have great destructive power uncommitted during his attack and untouched by our retaliation, he will be able to eliminate us as a nation. True, he will be damaged greatly but not as a much as we will. So, if he launches a surprise attack against us when we are in an inferior posture, we will be faced with surrender or with suicide. Who would choose suicide?

CONGRESSMAN ALFA: Are you saying that we must either surrender or go to war as soon as we can?

GENERAL BROADGAUGE: This doesn't follow at all, Congressman. What we are saying is that, if the United

(Continued on following page)

States does not want to strike first, and if, in addition, it wants to deter a Soviet attack on this country, we must acquire a second-strike force.

CONGRESSMAN BRAVO: Does this mean then that you commit yourself never to strike the first blow, and have to tailor our forces accordingly?

GENERAL BROADGAUGE: Not at all. It simply means that we must have a force which *can* strike first, in addition to being able to strike second effectively if the enemy succeeds in launching his surprise attack.

CONGRESSMAN ALFA: How about dispersing your bases?

GENERAL BROADGAUGE: Geographic dispersion over wide areas does not mean much in an age of global-range delivery systems. You can move your bases 300 miles to the south, or the west, and the attacker can still hit you.

CONGRESSMAN ALFA: What I meant was: Should you not increase the number of your bases?

GENERAL BROADGAUGE: To a certain extent, yes. But you soon run out of real estate. Furthermore, it is cheaper to build ten or even twenty more missiles than one additional base.

COLONEL WARGAME: Many people have proposed hardening of bases, but hardening is by no means a panacea. In the first place, it is very costly, and in the second place, if the enemy knows the exact location of the base and possesses high-accuracy weapons with great yield, he can mass-launch against hardened sites. Also the hardening of aircraft bases seems economically unfeasible.

LIEUTENANT COLONEL HARDSITE: But aircraft can be rotated at random through many bases, and also through civilian airports.

COLONEL WARGAME: Yes, but then you have to set up logistical facilities on all such bases—civil and military. Otherwise, you soon would lose control over your force.

CONGRESSMAN ALFA: You are really beating the drum for the Polaris system.

COLONEL WARGAME: Polaris is no panacea, either. It lacks the punch and accuracy of land-based systems, and it has no salvo capability, which may make the difference between victory and defeat. The submarines must be deployed throughout the oceans, and it would take days before all the Polaris missiles have been fired.

CONGRESSMAN BRAVO: Nevertheless, you would have an invulnerable attack system.

LIEUTENANT COLONEL HARDSITE: Maybe, for a year or so. But if the enemy can locate the subs within a few miles, he could launch ICBMs against them.

CONGRESSMAN BRAVO: What difference would that make? The ICBM could not hit a submarine.

LIEUTENANT COLONEL HARDSITE: No, but what would a five- or ten-megaton warhead, exploded at a depth of about 200 feet, do to the submarine? No one knows. And so long as we do not have nuclear tests, we won't find out. This means that we cannot entrust our fate to a weapon system which may be infinitely more vulnerable than present talking would indicate.

GENERAL BROADGAUGE: The Polaris system is not cheap. In fact, the Minuteman is superior in many respects. Its small launch site is harder to hit and not too expensive, if we were to harden it. And we will have the rail-mobile Minuteman, which the enemy might find very difficult to locate.

LIEUTENANT COLONEL HARDSITE: We cannot be sure, however, General, that space reconnaissance systems cooperating with an effective intelligence collection on the ground would not reduce some of the mobile Minuteman invulnerability.

COLONEL WARGAME: Any time we concentrate on a single delivery system we are very vulnerable. Any missile has significant operational limitations. Precisely because the enemy will also go into mobile delivery systems, sooner or later we need manned aircraft to ferret them out. And we also need aircraft to determine the enemy's movements, his evacuation centers, and troop concentrations. We must have aircraft to determine the effectiveness of our attacks and we must never forget that aircraft carry a heavier punch than even the largest missile.

LIEUTENANT COLONEL HARDSITE: It seems to me, too, that a modern war will not end after one or two strikes.

CONGRESSMAN ALFA: Do you mean to say that a nuclear war would last more than a few days?

LIEUTENANT COLONEL HARDSITE: Who knows? I am talking about the need for a multiple-strike capability. I could conceive that we would strike successively for one or two weeks. This still would be a short war, but it would be quite different from a two-blow war.

CONGRESSMAN ALFA: How on earth could you organize for such an eventuality?

COLONEL WARGAME: You might not be able to organize for it on earth. But there are at least two weapon systems in the offing which would give us precisely this multiple-strike capability and which also could be used to force the enemy into surrender. I am thinking about a nuclear-propelled aircraft with its practically unlimited endurance; its ability to hide at extreme distances; and its mobility, which, in terms of miles per hour, far exceeds that of either Polaris or Minuteman. I am also thinking about space systems, bomb-carrying satellites in orbit and instantly ready, as well as manned spaceflights made for specific one-time tasks, but these obviously are some way off. However, the nuclear-propelled aircraft could be accelerated if we put our minds to it.

CONGRESSMAN BRAVO: Do you mean to say that the nuclear-propelled aircraft would be invulnerable?

GENERAL BROADGAUGE: Nothing is invulnerable. But we are about to spend billions of dollars for the airborne alert of the B-52s for a marginal improvement in capability. The nuclear-propelled aircraft, by its very nature, has an innate airborne alert capability.

CONGRESSMAN BBAVO: Would you rather have the nuclear-propelled aircraft than the B-70?

COLONEL WARGAME: We cannot as yet build a nuclear-propelled aircraft with the same performance characteristics as the B-70. Until we can, there will be no substitute for the B-70. We must have it.

CONGRESSMAN BRAVO: Why then should the sub-

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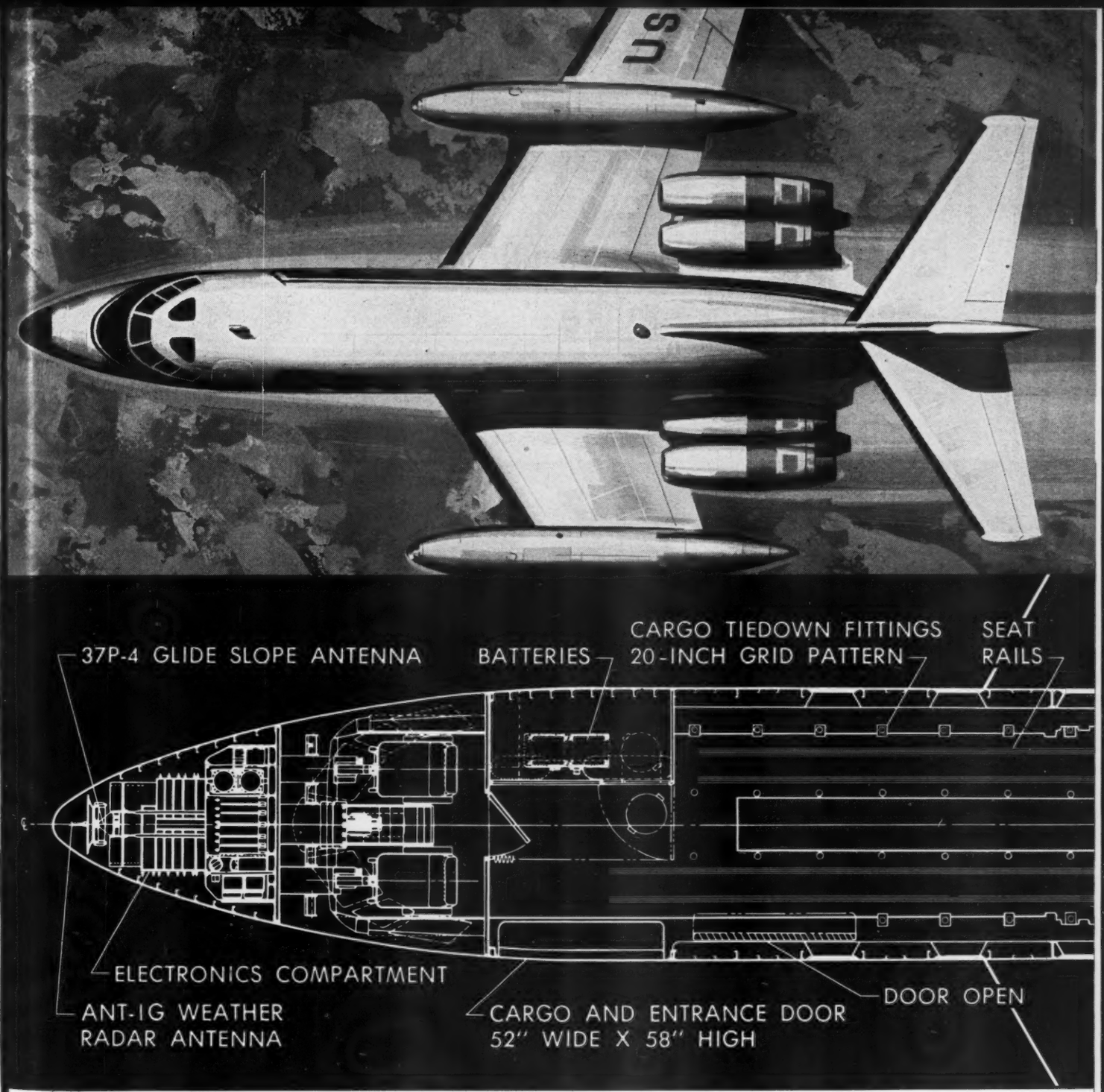

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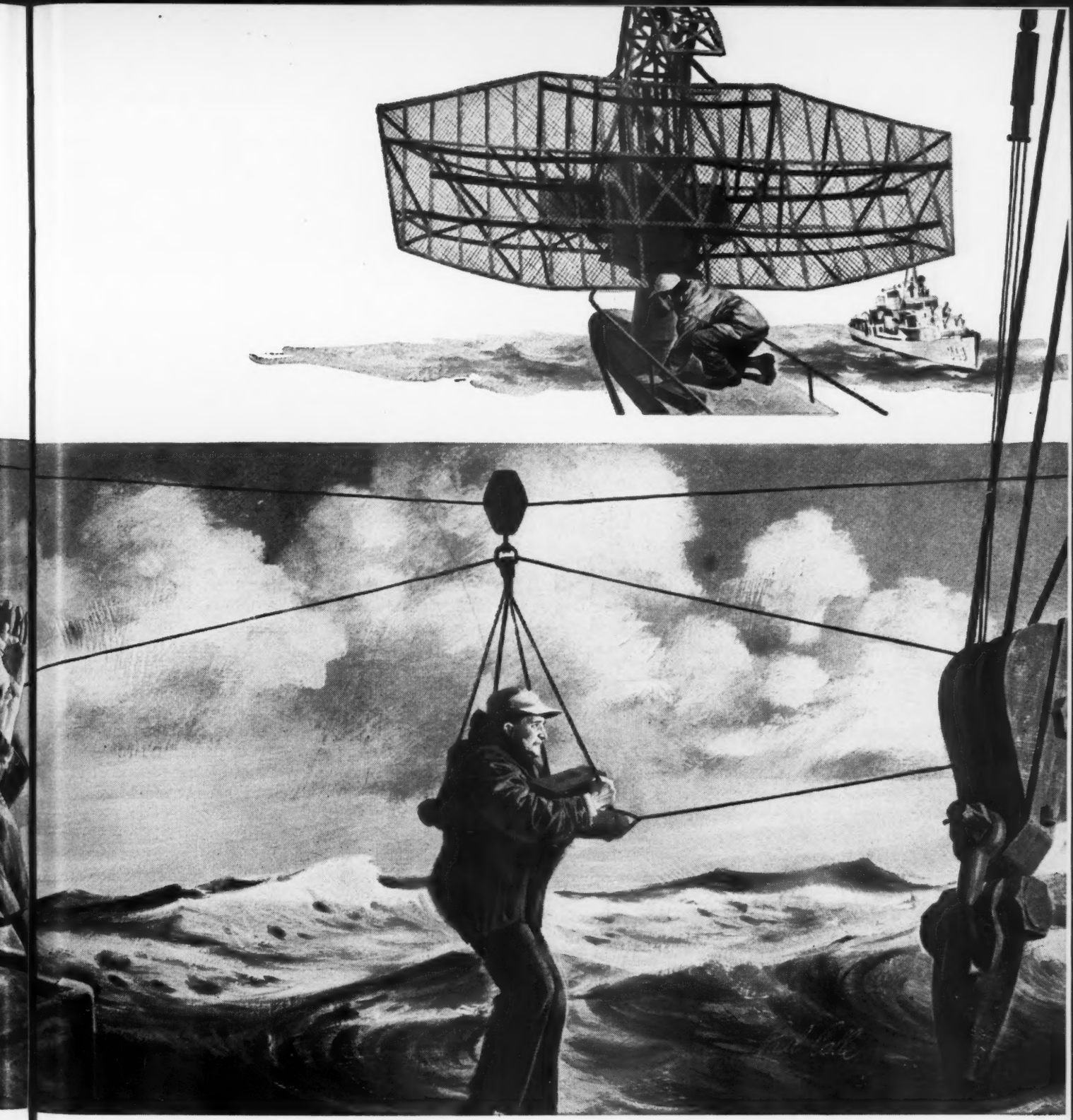

MINDING THE FUTURE

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sonic nuclear aircraft be anything but an experimental model, a test bed to learn the state of the art?

LIEUTENANT COLONEL HARDSITE: The subsonic nuclear aircraft, or possibly the transonic one, is obviously an interim vehicle. But, it could have its operational uses throughout the '60s, especially if it were equipped with air-launched missiles as well as high-yield bombs. Presumably, this type of aircraft could be used after the initial exchange during which the effectiveness of air defense would be greatly reduced. So, despite its low performance characteristics, the very fact that it can be on constant airborne alert, and that it can reach enemy targets fifty to 100 hours after the attack, could very well make the difference in the outcome of the war. Just as the ICBM is the ideal weapon for the aggressor, the nuclear-propelled aircraft is the ideal weapon for us and a second-strike strategy.

CONGRESSMAN ALFA: I've never heard this before. Our planners must have missed the obvious.

GENERAL BROADGAUGE: You do not want to sell the other systems short.

LIEUTENANT COLONEL HARDSITE: Nuclear propulsion is not restricted either to submarines or to manned aircraft. A great deal could be done with nuclear ram-jet and rocket missiles, in many configurations. Through nuclear propulsion we could get both larger payloads or, conversely, we could achieve much smaller missiles of intercontinental range and thus increase mobility and invulnerability on the ground.

CONGRESSMAN ALFA: Gentlemen, it seems to me you are falling into the trap of all military theorists. You are adding system on system without regard to costs and you never come back to earth.

COLONEL WARGAME: Congressman, some of the systems we have been talking about would replace others. Some would have to be used concurrently. After all, in the past, military forces always had more than one weapon system. The trick is to create the best "mix" within available resources.

GENERAL BROADGAUGE: The enemy will find it far more difficult to knock out our force if we do not oversell ourselves either on the hardened systems or on the mobile systems, but develop a mix.

CONGRESSMAN ALFA: I can see where a mixed system might complicate the attack problem to a point where attack may become entirely unfeasible.

GENERAL BROADGAUGE: Wait a minute. So far we have been talking merely about types of weapon systems. But let us make no mistake about it. In war only numbers count.

CONGRESSMAN ALFA: General, you're up to your old tricks. Do you really want a thousand copies of each system?

GENERAL BROADGAUGE: Not at all. I should have said relative numbers count. Suppose we have a second-strike force composed of land-based missiles, chemical and nuclear aircraft, and Polarises, operating partly from mobile and partly from hardened bases. And suppose that the enemy has an attack force that can hit our attack weapons, whether they are on or off a base, and furthermore, suppose he possesses a defensive system by which he can intercept most of those weapons which he missed in the first strike. Remember now, no hardened site is really invulnerable, no mobile site is really undetectable, and no submarine and no aircraft on patrol can hide forever.

CONGRESSMAN BRAVO: Aren't we back where we started?

COLONEL WARGAME: Not at all, because there are degrees of vulnerability, detectability, and interceptibility. The new systems boost the ante.

GENERAL BROADGAUGE: But that really isn't the point I want to make. Don't forget that the enemy is progressing just as much as we are.

CONGRESSMAN ALFA: So?

GENERAL BROADGAUGE: Just this: If, quantitatively speaking, the enemy has enough attack and defense weapons to neutralize our force, he is not going to be deterred. My argument is simply that, if we have numerical superiority in numbers of our weapon carriers, we can be fairly certain that we have achieved deterrence. If there is numerical parity, the degree of our deterrence is dependent on factors such as accuracy on his side, and hardening on ours, and we also may play his intelligence versus our mobility, his surprise tactics against our warning proficiency—in fact, we could play dozens of such games. The outcome would be uncertain. But if we have numerical inferiority we present him with an option to attack us.

CONGRESSMAN ALFA: Now I think I understand you. You are saying that if we reject preventive war but want to buy deterrence, we must have a second-strike force that can survive the enemy's blow. Such a force must be so big that, if the enemy unloads his entire strength against us, we still would retain enough military power to destroy him. Is this right, General?

GENERAL BROADGAUGE: Roger, Congressman. We must constantly improve the quality of our weapons and we must strive for the best possible mix of systems. But, the crucial point is to retain a substantial numerical superiority. If we pay for such a posture then we will not be forced into fighting a preventive war, and it is likely we can prevent war altogether. But if war should come nevertheless—aggressors are unpredictable—then we would not be knocked out, but on the contrary the enemy would be defeated. I cannot see any other rational strategy for the United States.

CONGRESSMAN ALFA: I must agree with you now, General. The thing that disturbs me, however, is that an argument which is so clear and simple is ignored by so many and apparently is lost in propaganda of the special pleaders.

GENERAL BROADGAUGE: Congressman, our so-called national debate about strategy reminds me of Nero's fiddling. If our sites were as hard as our heads . . .

CONGRESSMAN BRAVO: Don't get discouraged. Common sense . . .

GENERAL BROADGAUGE: Don't be too optimistic. Our people, as well as our executive and legislative leaders, are a long way from an understanding of the strategic challenge confronting our country. Rhetoric is no answer to nuclear bombs.—END

Behind locked doors in the Pentagon, secret session of the Air Defense Panel of USAF's Weapons Board is under way. Chairman, with pointer, is Col. Ralph C. Taylor, Chief of the Air Defense Division in Directorate of Requirements.

Reaching the vital decisions for which the Chief of Staff must take responsibility involves his reliance on the collective judgment of USAF's top experts in aerospace power. Four boards—the busiest of them keeping 500 men at work on the choice of weapons that will defend democracy—provide a unique system of checks and balances as . . .

USAF MAKES UP ITS MIND

Claude Witze
SENIOR EDITOR

MR. FORD. *Was there unanimity of opinion in the Air Force to request $456 million in fiscal 1961 for the B-70 program or was there unanimity of opinion in the Air Force to request the B-70 program to be partially financed?*

GENERAL WHITE. *I think I will have to put it this way, sir. There are two major review groups within the headquarters of the Air Force. Obviously, when you say "the Air Force," I assume you mean headquarters. We did not take a poll. There is the Weapons Board and there is the Air Force Council. I would not like to have the records of these organizations normally exposed, but this is a good time to answer the question in clean-cut terms. At the time this was under consideration, we had both the F-108 and the B-70 in the program. We were told, and it was clear, that . . . we could not have but one of these manned aircraft and that the budget would not carry but one, if it would even carry one. The Weapons Board went on record that we should have both, but if we could only have one, we should have the F-108. The Air Force Council, which is the higher body, just exactly reversed it. They said that we should have both, but if we cannot have but one, we should have the B-70.*

It came to the Chief of Staff, who spent many sleepless nights over this problem, and decided from many factors that if we could only have one, the B-70 was it. I based that largely on what would be the greatest threat to the Soviet Union, and hands down, the B-70 wins that argument, in my opinion.

THIS exchange, between a member of the House Subcommittee on Defense Appropriations and Gen. Thomas D. White, US Air Force Chief of Staff, took place on Capitol Hill late last January.

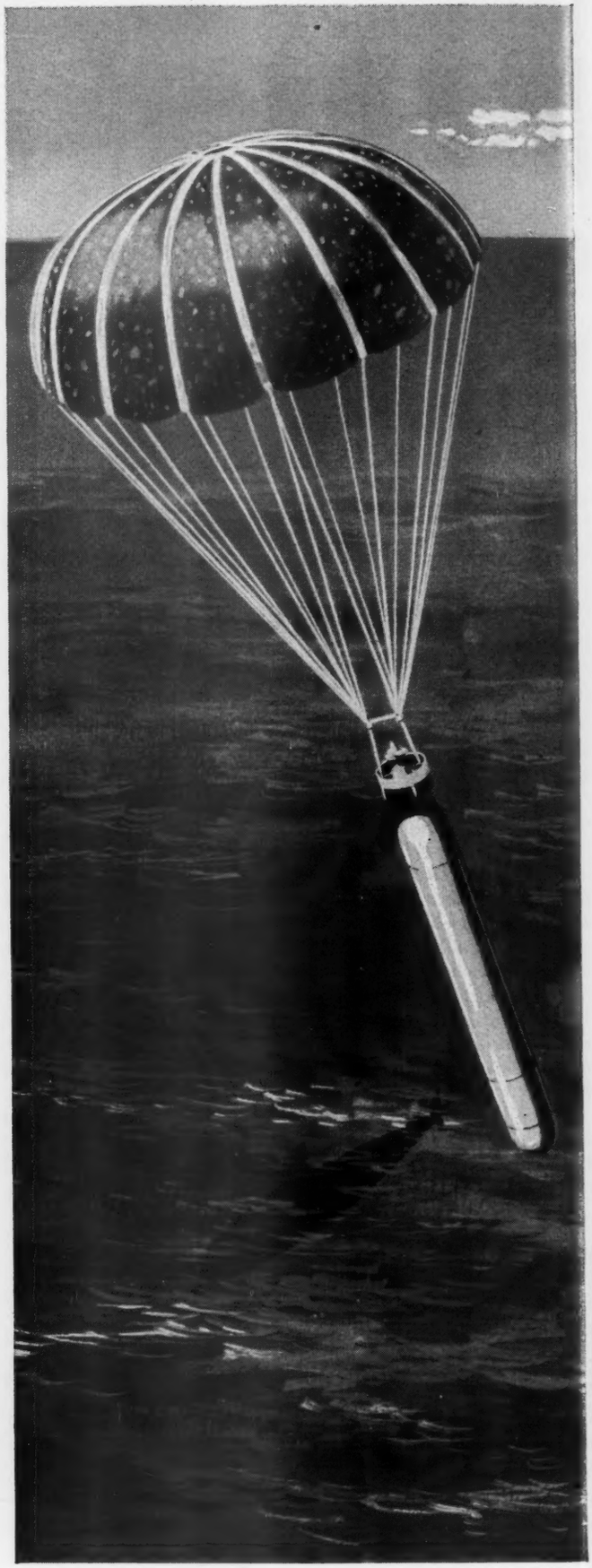
It passed unnoticed, certainly by the nation's press and possibly by a substantial number of legislators, including some who think the military services are irresponsible shoppers. The exchange was unusual, not alone because it spotlighted the kind of exercise forced on military men in an age of intense technological competition and budgetary limitations, but because it contains the first known public reference to the USAF Weapons Board.

General White's guarded acknowledgment that it is not normal to talk about the Air Force Council and the Weapons Board had nothing to do with their failure to agree on the choice of a Mach 3 weapon system. This reticence exists for all of USAF's top decision-making and advisory machinery. And it must be made clear that the decisions are made by the Chief of Staff and the Secretary of the Air Force, the top military and civilian officers. The machinery is deliberative and advisory.

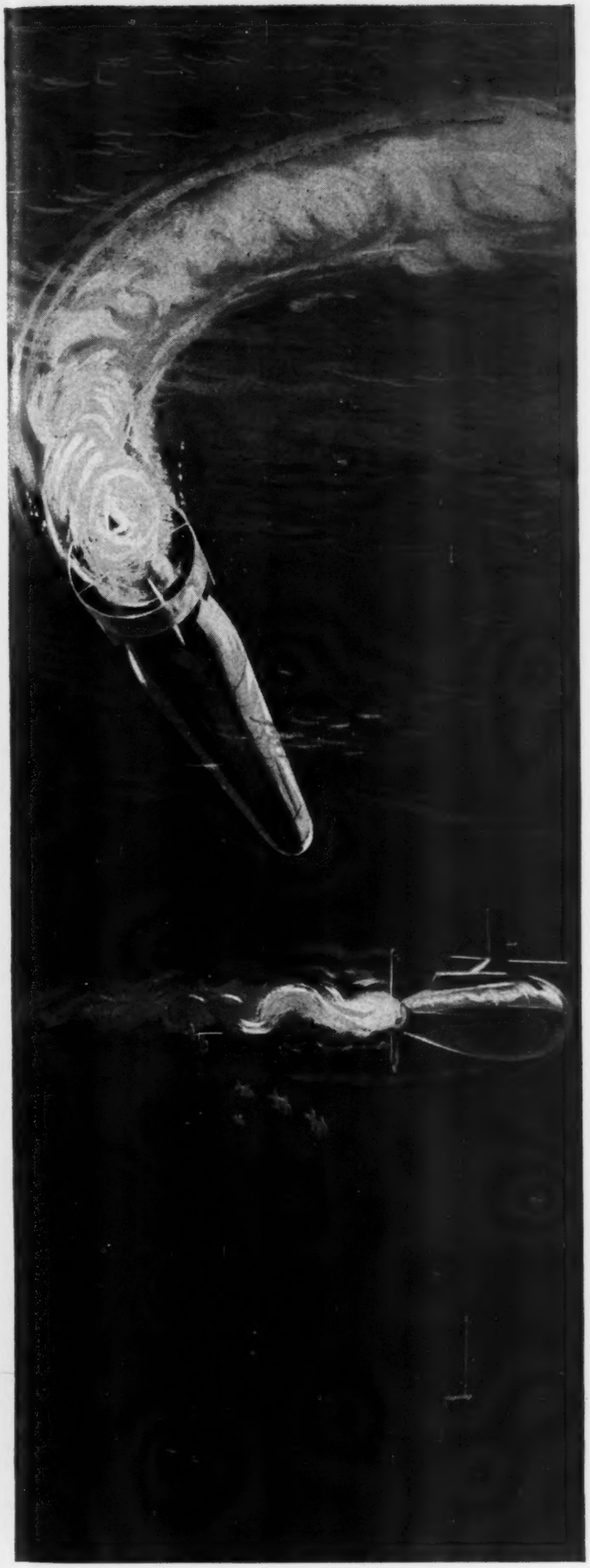
For purposes of this discussion the Weapons Board has been singled out because of its importance in the midst of a technological explosion that has outmoded, in less than a decade, all previous concepts and practices of military procurement. Yet the Weapons Board is only one of four deliberating bodies with an identical relationship to the Air Force Council. Others are the Force Estimates Board, the Budget Advisory Board, and the Military Construction Board (*see chart*). With the Council, they provide collective judgment by the

(Continued on page 68)

1. Within seconds after detecting an enemy submarine, a shipboard computer automatically charts the sub's course, range and speed . . . then aims the missile launcher. Upon command, a rocket-propelled ballistic missile is fired.



2. The missile follows a ballistic trajectory, shedding its rocket motor and airframe before water entry. When the payload is a torpedo, a parachute blossoms in flight to slow the missile's plunge into waters near the target.



3. After hitting the water, the ASROC torpedo becomes activated by the energizing of a sea-water battery. Then, the missile begins an acoustical homing search from which it locks onto its target and pursues it to destruction.

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The ASROC concept was based on present knowledge at the time the program was initiated, but it remained for exhaustive test programs, carried out by the Navy-Honeywell team, to develop ASROC from idea to hardware.

Early in the program, prototype missiles were test fired statically and from moving platforms at the Naval Ordnance Test Station to obtain aerodynamic research information. Engineers measured, recorded and computed items and distances for thrust termination, airframe separation and payload impacts.

Hydroballistic information was obtained from dummy payloads fired into the water from a test stand and dropped from airplanes into a hydrophone range. Calculations on trajectory, hydrodynamic stability and depth-time ratios contributed to design. Throughout the development program, more than 200 test firings were conducted.

The result is an integrated weapon system consisting of an underwater sonar detection device, an electronic digital fire-control computer, a missile launcher, the ASROC missiles and all necessary training equipment.

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COMPOSITION OF USAF'S WEAPONS BOARD

In addition to the eight panels shown on this chart the Weapons Board gets support from a Program Review Committee that monitors the entire program. The panels, designated by mission, carry on a constant review of each system in development and in operation, making sure they can perform their tasks. There is a Working Group for each Air Force system.

best brains in USAF, and it is a relatively rare case that has the potential of giving General White, or any Chief of Staff, many sleepless nights.

The most closely guarded of the advisory groups is the Air Force Council, which usually meets on Thursday to consider an agenda that is so secret copies are available only to the members, who receive them hand-carried from the office of the Council secretary. Gen. Curtis E. LeMay, Vice Chief of Staff, is Chairman of the Council. Other members are the Deputy Chiefs of Staff for Development, Materiel, Operations, Personnel, and Plans and Programs. Two more are the USAF Comptroller and the Inspector General. All wear three stars.

Nobody else is admitted to the meetings without a special plea from a Council member, who must explain why his would-be guest is essential to conduct some of the discussion on the day's program.

"The Council meets for business and to serve as an advisory group to the Chief," says one of the important officers, "and it does not meet for the education or edification of the staff." He puts more emphasis on this aspect by giving the Council members credit for "doing their homework." The agenda is distributed far enough in advance of each meeting that the seven three-star generals have time to marshal the opinions of their own staffs and be prepared for a stern examination of new proposals.

The Air Force Council, like the Chief of Staff himself, draws on all four of the Boards for collective expert opinion. But the busiest of the four is the Weapons Board, not because it is any more important than the groups dealing with force estimates, the budget, or military construction, but because it has a bigger and more complex job to do. More than 500 men are involved in its deliberations.

There is a studied aura of mystery about the operations of all the boards that is most evident in the case of the Weapons Board. Of the small army of aerospace industry representatives working in Washington, some of the best informed are barely aware that there is a Weapons Board. Many do not know who is on it, what it does, how it operates, or why it was originated. They do not know what kind of power, if any, it wields over USAF procurement decisions. They view the Weapons Board, if they know there is one, as a kind of quarantined Pentagon delivery room where fathers are banned.

The Pentagon telephone directory, which provides substantial information about such things as the military intelligence organization, has bare mention of the Air Force Council and the Weapons Board. For the Weapons Board, the directory lists only a secretary and assistant secretary on the staff of the Director of Operational Requirements, under the Deputy Chief of Staff, Operations. Normally, says a USAF Headquarters instruction, no reference shall be made to Council or Weapons Board activities "in any form of communication to the major air commands, to other government agencies, or to private concerns or individuals." General White clearly took an exception to this when he told the House committee about his mental exercise over the B-70 and F-108 selection.

The Secretary of the Weapons Board who probably knows more about USAF procurement intentions and the prospects for individual programs than any other working-level officer is known to few contractor representatives. Weapons Board territory is "off limits" to these agents, and the receptionist in the Weapons Board office politely but very firmly enforces the policy.

The Board is concerned with the selection of a system to fill a requirement. It makes recommendations on the choice of a system or a modification program or a research effort. It determines what the Air Force needs, when it needs it, and goes through the painful process of deciding how it can be paid for. It then recommends to the Air Force Council the weapon system, development, or modification program necessary to meet the requirements and the necessary adjustments to the Air Force program to accommodate the recommendation. However, the Weapons Board has nothing to do with the choice of who will do the work.

Contract source selection is a question that never comes before the Weapons Board. AMC and ARDC operate their own Source Selection Boards, whose choice bypasses the Weapons Board, and goes, sealed,

General Holloway

General Demler

Colonel Smith

General Martin

General Spicer

General Agee

General Friedman

direct to the Air Force Council, the Chief of Staff, and the Secretary of the Air Force.

The Weapons Board is the focal point of Air Staff actions on all USAF weapon and support systems. Under the Air Force Council, it is the top review organization for procurement, development, military assistance, and aircraft and missile modification. Yet the Board never makes a decision; it makes recommendations. It is an advisory body, providing collective judgment. When its judgment is determined, normally copies of the recommendation are highly restricted. They are held only by the seven members of the Board, the Deputy Chief of Staff for Operations, and the Vice Chief of Staff, who is Chairman of the Air Force Council.

The Chairman of the Board is the Director of Operational Requirements, under the Deputy Chief of Staff for Operations, a billet currently filled by Maj. Gen. Bruce K. Holloway, who was told when he got the appointment that his Board Chairmanship is the most important part of his job. He got this evaluation from the Vice Chief, General LeMay, who was a driving force in the formation of the Board more than two years ago.

Other members are:

- Director of Systems Development, DCS, Development: **Maj. Gen. Marvin C. Demler.**
- Director of Procurement and Production, DCS, Materiel: **Col. Marion C. Smith.**
- Director of Plans, DCS, Plans and Programs: **Maj. Gen. Glen W. Martin.**
- Director of Programs, DCS, Plans and Programs: **Maj. Gen. Prescott M. Spicer.**
- Director of Operations, DCS, Operations: **Maj. Gen. Sam W. Agee.**
- Director of Budget, Comptroller: **Maj. Gen. Robert J. Friedman.**

Other officers take part in deliberations when the problem before the Board makes it necessary, but the chairman is determined to keep the group small.

This approach grows, at least in part, out of the conviction that it is possible to get too much information, too many opinions, and too many pressures.

The Board can be viewed as an evolution from the old Aircraft and Weapons Board, which had fifteen members and, in the opinion of some veterans, tended to degenerate into a debating society. General Holloway, chairman of the present Board, hopes through keeping the group small to keep a lot of hands out of the gigantic taffy-pull that always develops from any discussion involving the expenditure of money.

None of the using commands are represented on the Board, and their spokesmen can be present only by invitation. Thus there is no opportunity at board level for the men responsible for the force in being—Strategic Air Command, Tactical Air Command, Air Training Command, Air Defense Command, etc.—to apply direct pressure for the systems each considers most essential.

At the same time the Board, in reaching its recommendations, most certainly is torn between the present requirements of these commands and its concern for the future. The field commander, by the nature of his responsibility, is as determined to maintain today's aerospace power as he is to keep a safe balance in his checking account. But the Board has a broader responsibility. It must look to the future and make sure there will be something to draw on in 1965. There are cases, on the Board record, where the force in being has intentionally been allowed to suffer in order to guarantee that the requirements of five years hence can be met.

Specifically, the Weapons Board is responsible for reviewing and making recommendations on the procurement programs under these budget classifications: aircraft (P-100), missiles (P-200), other procurement (P-800), and research and development (P-600). All of these programs and any major changes in them must be staffed through the Board for review and approval before they are submitted to the Air Force Council and the Chief of Staff.

On top of this, the Board has responsibility for the Military Assistance Program and programs for aircraft and missile modernization and modification. It is charged with monitoring the progress of each weapon

(Continued on following page)

system as it matures from concept to operational capability and passes on all program changes. The sum effect: The Weapons Board is the focal point of all USAF dollar programing. It is the highest USAF advisory group on that belabored question of national security: What do we need, and how much of it can we afford? Its functioning is antithetic to the abused concept that this dilemma is ignored by men in uniform.

Below the seven-man Board, the structure starts with eight panels, each headed by a full colonel who also is a division chief in General Holloway's Directorate of Operational Requirements. There are panels in each of the following mission areas: Strategic, Air Defense, Tactical, Transport, Reconnaissance, Training, Support, and Space. As a rule the panels have from eight to ten voting members and an average of eight adviser members. This puts representation of sixteen to eighteen Air Staff Directorates on each panel. The panel responsibilities are similar to those of the Board itself, but each one is confined to an assigned mission area. It is at this point that a close and constant liaison is maintained with the using commands.

The Board structure then moves down to a level of Working Groups, made up of Air Staff project officers. Each is charged with responsibility for monitoring a single weapon system, and is designated accordingly. The groups provide an informational service for both the panels and the Air Staff. They are the focal point for all Air Staff activity on each weapon system and the chairman of each one rapidly picks up a nickname in the requirements community as "Mr. B-52" or "Mr. F-105" or "Mr. Hound Dog."

Working Group size varies according to the complexity of the system and where it is in the concept-to-operational status cycle. At some stages, some Air Staff directorates will have no interest. Later they may become deeply involved. With some systems—such as the heavy bombers—almost every directorate is involved. Membership in the group can vary from seven to more than twenty.

Chairmanship of the Groups is rotated in accordance with the shift of executive responsibility between ARDC and AMC. This corresponds to the transfer used by the procuring commands, where the chairmanship of the Weapon System Project Offices (WSPO) is changed as the program moves from development to procurement responsibility.

General Holloway says the Weapons Board, which is in reality composed of the seven members, plus the panels and Working Groups, is called upon for a recommendation at all principal milestones in the life of every system. The key decisions, which must in the final analysis be made by the Chief of Staff and the Secretary of the Air Force on the advice of the Air Staff, get their closest scrutiny from these men.

At the same time it is emphasized that none of the plentiful contractor proposals are evaluated by the organization. This is a job done by ARDC, and the Board has no knowledge of them—or who originates them—until they are submitted by ARDC or AMC or a using command. A proposal can, of course, be almost anything from a suggested new major system to an alteration in a landing gear or an improvement in an electronic component.

The concept, widely held and frequently dispensed to the public, that military decisions in the procurement area—in this case USAF decisions—are made by promiscuous spenders usually is spread by people with little or no knowledge of the Board's activity. A two-star general in a position to determine military requirements or help make procurement decisions is not in a position to act like a teen-age girl loose with a charge account at Saks Fifth Avenue. The checks and balances, which here include a coordination of information and expert evaluation, are almost infinite.

And the fact stands out, prominently in the minds of all 500 officers involved in Weapons Board recommendations, that it is money and money alone that is the major problem. General Holloway says that the Board, which has had meetings that ran for nine uninterrupted hours, has its arguments across the table. And in ninety-nine percent of the cases the argument is about USAF capability vs. availability of buying power.

Weapons programs must continually be backed up, stretched out, or canceled entirely. The system, strangled by the one-year budget cycle, forces the bulk of the Weapons Board's effort into the job of reprograming and reviewing. In most cases, it is higher-than-anticipated costs, poor cost estimates, a lowered budget ceiling, new production problems, or an over-optimistic development program that is responsible.

The Board must always come up with a recommendation that covers the operational concept, the proposed financing, and the proposed production schedule. General Holloway must present this to his superiors and defend the program against their expert criticism. The Office of the Secretary of Defense is still another level of review with even more skeptical critics, and they are critics who have a veto power exercised by pulling purse strings.

It has been pointed out that this insistent influence of the dollar sign is relatively new to the military. It is a phenomenon that grows almost entirely out of the fact that modern weapons are staggeringly complex and costly, one reason why the machinery for reaching decisions is so complex. There is no major military decision that can be made today and no major plan that can be considered without a study of its financial implications. Each year there are hundreds of approved decisions and plans that have to be reworked—by the Weapons Board—because of some action involving money that came from outside the Air Force itself. There have been years when eighty-five percent of the research and development resources had to be reprogramed.

In a real sense, the Weapons Board is a key command on the fighting front in today's technological war. Starting with our first attainment of nuclear weapons and the first crude methods of delivering them, we have been spending more money in technological development than in any other area. This has been expensive—but distinctly preferable to the alternative, the decadence of our deterrent strength.—END

THE SPACE AGE IN PERSPECTIVE

SPACE DIGEST

VOLUME 3, NUMBER 11 • NOVEMBER 1960

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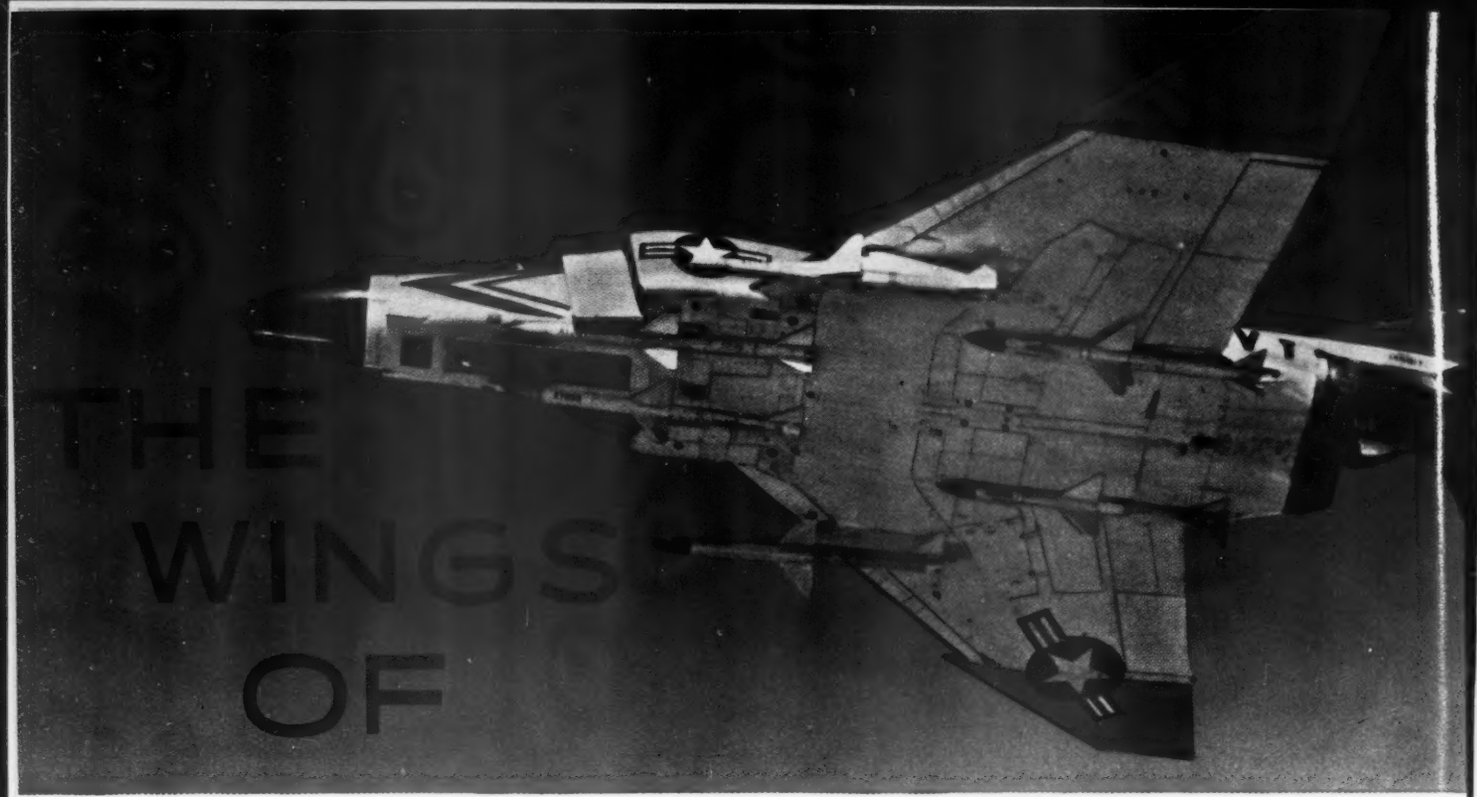

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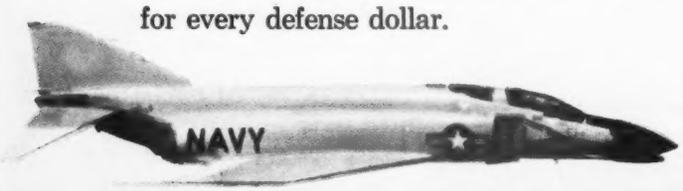

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The public needs facts, not fancy . . .

LET'S TALK SPACE SENSE

GEORGE R. ARTHUR

President, American Astronautical Society, at AAS West Coast Meeting, Seattle, August 8, 1960

SPACE technology has had more popular appeal, certainly more exposure, to the public than any technological discipline before it. They say that those of us in the scientific community are somewhat separated from the laymen and it is somewhat difficult to convey our information and our work and understanding of this work to the public at large. The public needs an authoritative responsible and rational evaluation of all the space programs. Who can fill this need?

There is a definite tendency in this day and age, through the medium of the Sunday supplement and other information media, such as TV, to engage in what might be called space charlatanism. The public is constantly besieged by all sorts of predictions, stories, pictures, artists' conceptions, and the like about spaceflight in the future. We all know that much of this may come to pass some day, and some of this material is informative and necessary. However, the effect of this present situation on the public is to give them a rather jaded outlook toward space technology. They get the feeling that things are easy, things have been achieved that are still many years away. Thus, if it is ever necessary to go to the people with the pleas for more sacrifice, more taxes, and a bigger effort—and this I feel we must do—their reaction may very well be hesitant in that they feel that much of what we want to do is already done. Therefore, it would seem that the impact of the bigger and bolder program in space on the public in the terms of the financial support and technical manpower that must be given to these programs should be emphasized now. There must be sound technical correlation between what we predict, what we plan, and what we can do. This picture must make sense to the laymen. In addition, the public must be made aware of this correlation.

There are many who feel that we are lagging behind our rivals, the USSR, in achievements in space technology. We can be quite proud of some of our achievements in terms of the number of satellites that we have put up and the amount of scientific data that we have obtained and circulated quite freely. However, I would decry those who become complacent because of this, who engage in backslapping and tell us how wonderful we are. I would decry those who measure our position relative to 1948 instead of in real time relative to our true adversary, the Soviet Union. The time is now to say, not how good we are, but how much better we can be and to examine what we must do to achieve preeminence. The government must do considerable soul-searching to determine if we are doing all we can in space technology today. Recently, NASA released its revised ten-year plan for space exploration. It is a fine plan, but is it bold enough to meet the challenge of the decade? The new Administration must face this question.

What contribution can we scientific people make in this area? By holding meetings, by presenting papers, by informal discussions at the meetings, we communicate ideas, we determine the state of the art. In this way then, we form a basis for decision as to what can be done, what progress the technology can make, what is feasible, what is practical.

The United States has tremendous scientific and technical potential. We must not diminish this potential by a conservative approach in our space programs, by squabbling over who does what and over the long pull by what appears to be a serious deterioration in quality in our educational system. Let us hope the exchange of information and the reporting on technological achievements and ideas at scientific meetings will help us in making decisions and implementing programs that will keep the United States at the top. In our lifetimes, we will probably see a challenge to the final full measure of democracy—can a free people sustain an intensive competitive technical effort without the patriotic stimulus of a hot war?—END

Is the earth steadily losing mass? Did such loss stir the genesis of animal life? Will a continued mass loss someday spell death for human life on this planet?

A NEW THEORY OF CREATION

REGINALD O. KAPP

ACCORDING to the now-accepted view [that matter has an infinite life] there is no reason to suppose that physical conditions on earth have changed very significantly during the past two thousand million years. The temperature must have been about the same in the remote past as now. There must have been sea and land and the same atmosphere. Science fiction may speak of swamps and twilight and a primordial slime, but geology does not seem to justify such flights of imagination. Nothing is known against the conclusion that the same plants and animals that live today, including man, would have found the earth a congenial place in those distant times. Why then, one is led to ask, did they not occur for so many hundreds of millions of years? Was the earth really, it has to be asked, hospitably ready so long ago for the forms that

exist today and did they really wait all that while before they accepted the invitation? If the earth had the same climate and other physical conditions so long ago, why the grand evolutionary cavalcade, in which species evolve, have their brief era of dominance, become extinct, and are succeeded by others? Why did those species that occur now not evolve earlier? Why did the early species not survive to this day?

One possible answer is that evolution is a slow process and that during those past hundreds of millions of years plants and animals have been adapting themselves ever better to conditions on this planet. But the answer is hardly tenable. We know that evolution is not as slow as all that. Pronounced evolutionary changes come about during periods of time that are quite short by the geologist's time scale. The complex history of mammalian evolution was completed in only a couple of hundred million years. At this rate one should expect that evolution from amoeba to mollusk would have been completed at least eighteen hundred million years ago. But the first known mollusks seem to date from Cambrian times, only five hundred million years ago. Fifteen hundred million years for evolution of the first thing that could leave fossil remains is too long. It does not equate with modern genetic knowledge.

We also know that the species that are now extinct must have been well adapted to their surroundings, for they did survive for many generations. On a rational interpretation of evolution there can have been but little scope for improvement. Yet no species that lived in Cambrian times has descendants today that resemble their ancestors sufficiently to be classed as the same species.

A possible answer to the question why every early species has become extinct is that there was too much competition with more successful rivals. According to this view every kind of plant and animal that ever lived on earth would have living descendants like itself today were it not that it was either preyed upon or starved to the point of extinction by more competent later arrivals. To say this is to say that adaptation to the physical circumstances of the inanimate environment was perfected a long while ago and that since then adaptation has always only been to the competitive circumstances introduced by living things.

This answer might explain the occasional extermination of a few species but not, it seems to me, that of every species that existed a few hundred million years ago. It is true enough that nature, as the poet said, is red in tooth and claw; the struggle for survival is indeed fierce. But the opposed forces are closely balanced. The conflicts that we observe today rarely result in the complete elimination of one of the warring species. What more often happens is that the one gains no more than a relative ascendancy over the other. The world is, moreover, not so densely populated that the various species are in continuous conflict. Many survive by the simple process of avoiding those stronger than themselves. Animals that are preyed upon remorselessly go on having descendants for many millions of years. Why should the day have come for every one of them when there could be no more descendants of the same form?

The answer that physical conditions have been steadily changing seems to me to provide a far more satisfactory explanation of the evolutionary trend than the answer that the sole cause of change has been competition. But no other reason for a change in physical conditions seems to have been found except the change in the mass of the earth that I am claiming. This change means a corresponding change in the value of G [gravity] and must have very pronounced and varied effects. I do not here pretend to give an exhaustive list of these, but only to mention some samples in the hope that others may further explore the field. I feel sure that it will prove a rewarding one.

If [my calculations are correct] the weight of everything was more than three times its present weight two thousand million years ago. This must have caused the earth to be a very different place from the congenial earth that we know.

The atmosphere was squeezed into a much thinner, if denser, blanket than our present atmosphere. There will have been but little evaporation of water in the dense air. Clouds must have been rare. Far from the twilight postulated by the romancers, the land and the sea must have been under a fierce glare. When clouds did form and shed their rain, each heavy raindrop must have fallen with a great speed and reached the ground with destructive impact.

At the high density of the air small local differences in temperature must have caused large displacements of air, so that average wind velocities must have been very high. At the same time even a low velocity, such as would be a gentle breeze today, must have had the force of a hurricane when the air was so much denser. The gales that swept the land must have been devastating and will have carried sand and pebbles, even great boulders, along.

When conditions on land were so violent, the sea must have been the only safe place for living things. If any vegetation at all could maintain

itself on land, it must have been of the kind that clings to rocks like some of the present lichens. Anything that protruded a frond above the rock face would have been torn off by the raging tempests.

Before there were plants to put oxygen into the air and to provide food there could be no animals, and—as there could be no land plants until G had fallen to a level at which the earth had a tolerable climate—one should not expect land animals to have appeared until comparatively late in geological times. Even sea animals must have kept themselves well out from land. For only the tiniest of creatures could have survived the violence with which waves must have broken on the seashore in those times.

When G had several times its present value, a branched tree was an impossibility. No kind of wood would have been strong enough to support those cantilevers that we call branches. Stalks could not have borne the weight of fruit. Even leaves would have been a burden. If a plant could find a place to grow sheltered from the gale, it would yet have to have such a structure that its leaves would not drop off by their own weight.

Similar considerations apply to the early animals. No bull could have been strong enough to support its cantileverlike head. Bones and muscles could not have supported the tissues of any large animal. So one need not be surprised that, right up to the carboniferous period, there were no large animals. It was only then, when, by my estimate, G had not much more than twice its present value, that the amphibians began to evolve.

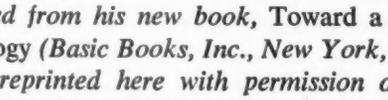
When G is great it is obviously easier to crawl than to walk. Hence the great saurians, which lived in the days when our coal deposits were being formed, were eminently adapted to terrestrial conditions of the times. It may also well be that they did really live in swamps. For they could then keep their heavy bodies submerged so that some of the weight would be borne by the water. As G decreased, their descendants will have raised more and more of their bodies above the surface. But nimble four-footed creatures had to wait until the weight of the mammalian body had dropped to a value at which slender stiltlike legs could support it; and then the first such creatures could only be small ones.

So far I have only discussed those conditions that, from our present point of view, seem to have made the earth increasingly hospitable. I have spoken of the conditions that made later arrivals possible. But did the decreasing value of G not perhaps make the earth *less* hospitable to its previous inhabitants? Was there no change of the kind that would make the earth impossible for them?

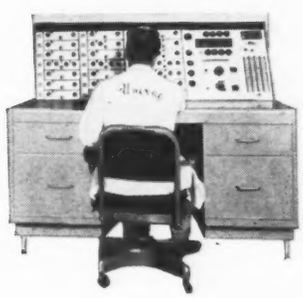
There must have been such changes, too, and a rewarding field of research would be to discover what they were. I shall be content to mention one obvious one. It is the decreasing density of the air. The heart, the blood, and the lungs of the great saurians must have been adapted to the air pressure of their day. As this pressure decreased, they must have found themselves starved for oxygen. It may be that the descendants of us, who are alive today, will become extinct for the same reason. According to the hypothesis of continuous extinction, the time must come eventually when the earth will have so little mass that, like the moon now, it will no longer retain its atmosphere. But long before then the air will have become so rarified that creatures adapted to a pressure of one kilogram per square centimeter will not be able to get enough air to support life. Neither a violent cataclysm, nor cold, nor heat, but lack of oxygen seems most likely to bring the end about.

If gases and solids have been heavier in the past than they are now, so, of course, have liquids. When G was much greater than it is now, sap could not have risen in a tree. Nor could any animal have had a heart powerful enough to pump the heavy blood to a level much above that of the heart. The shape of a lizard was then better adapted to environment than the shape of a giraffe. While the heavier air could support the heavy body of a flying animal, monkeys could not readily have swung from branch to branch of trees.

In particular, one may surmise that man's erect posture and the enormous development of his brain had to wait until G had fallen to an appropriate value. A creature that held its head well above the ground and whose brain needed so copious a supply of blood could not have survived in a world where blood weighed much more than it does now.—END



Reginald O. Kapp is a British engineer and educator with an intense interest in cosmology and the philosophy of science. The above material is excerpted from his new book, Toward a Unified Cosmology *(Basic Books, Inc., New York, $6.50), and is reprinted here with permission of Basic Books Inc., New York.*



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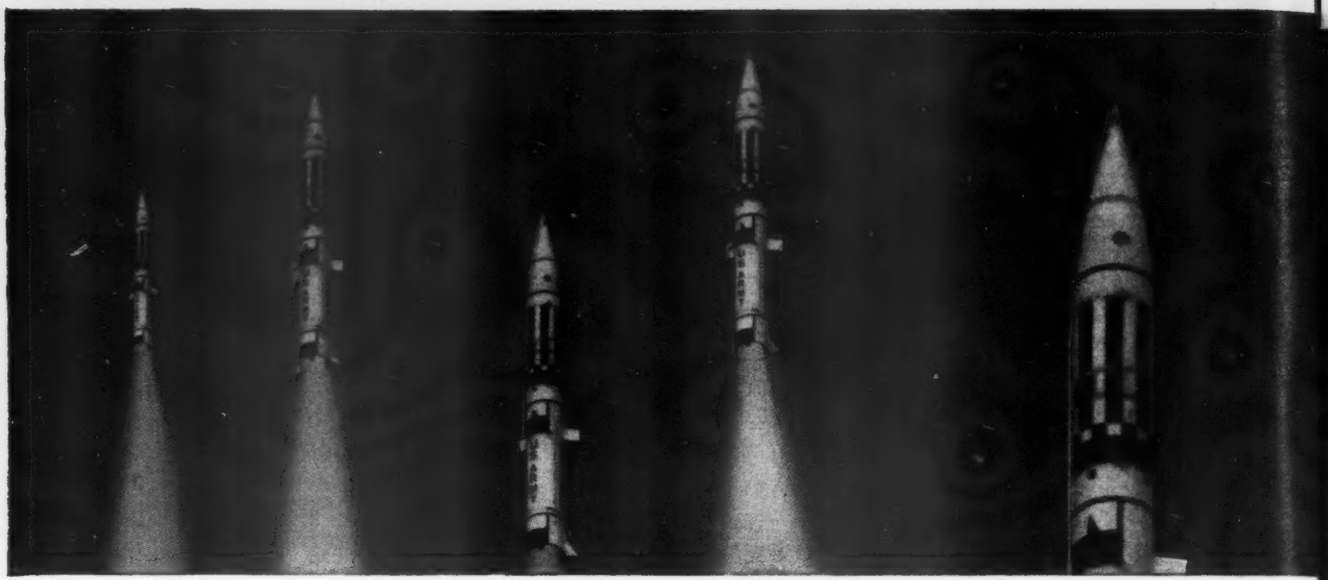

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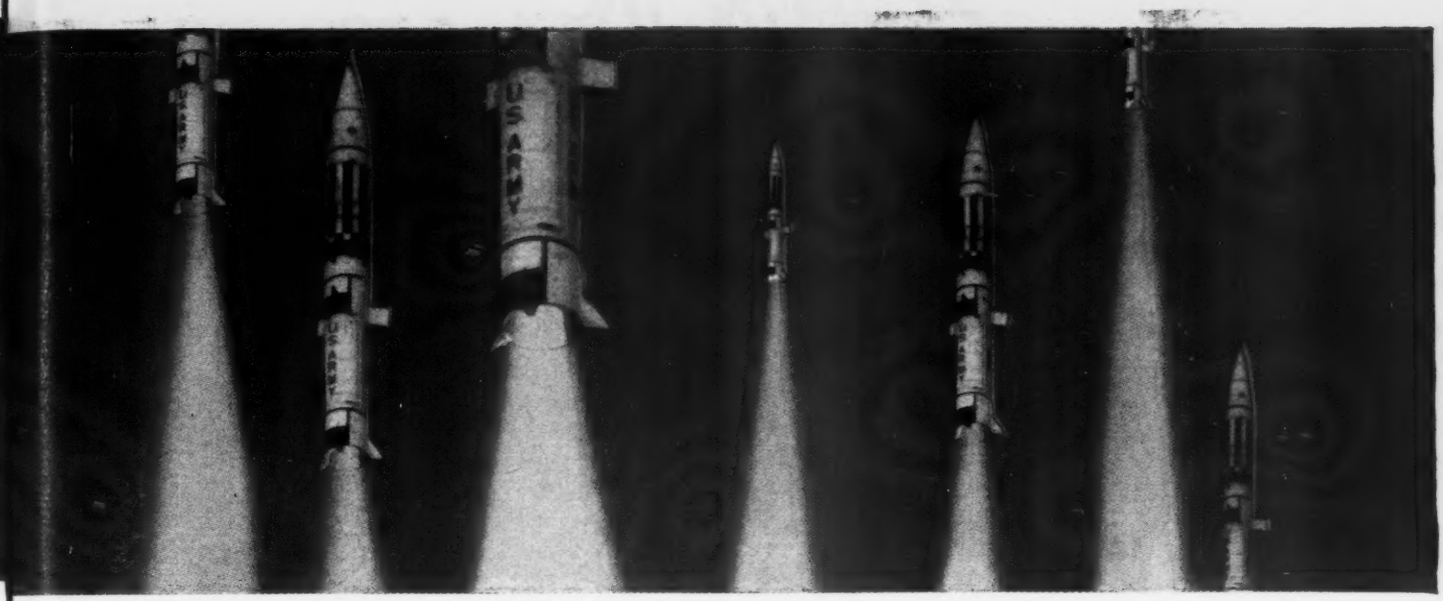

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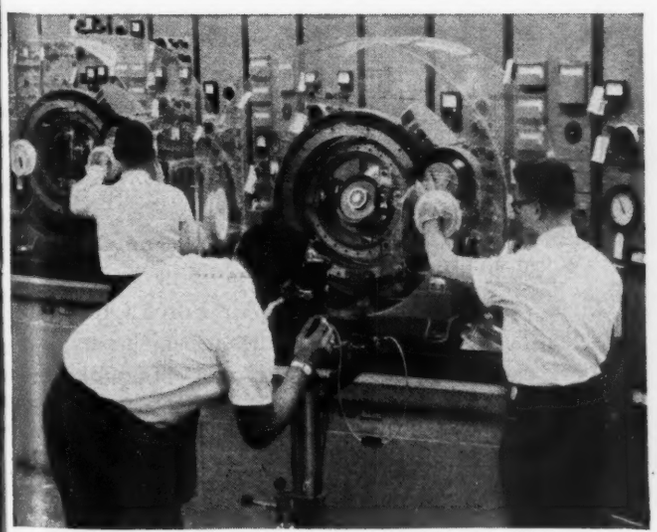

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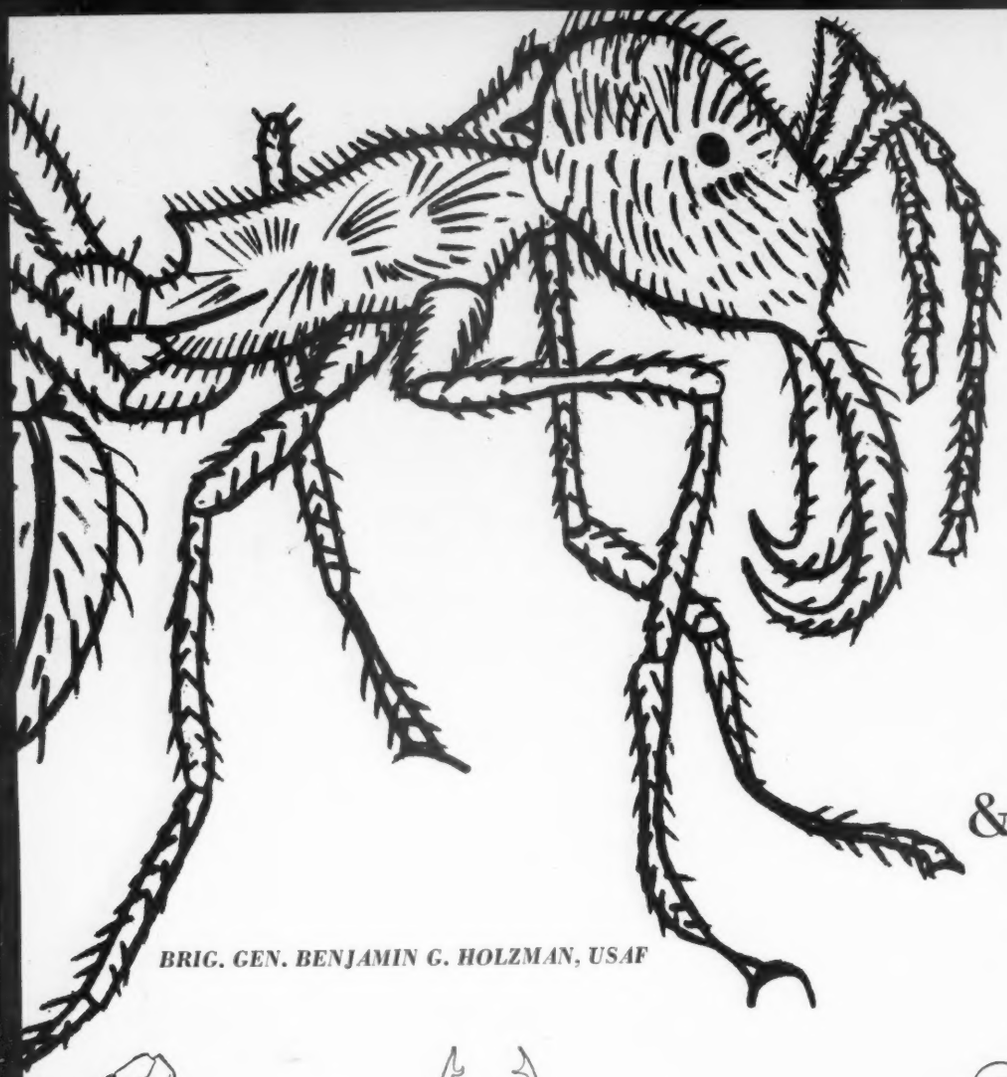
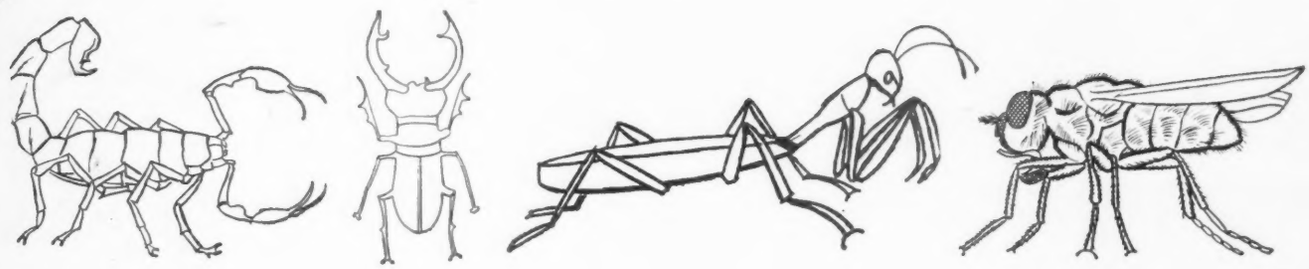


The uncanny instincts and amazing skills of lower life forms are providing scientists with new clues to improved technological devices. An Air Force scientist comments on . . .

BIRDS, BEES, & BALLISTIC BEASTS

BRIG. GEN. BENJAMIN G. HOLZMAN, USAF

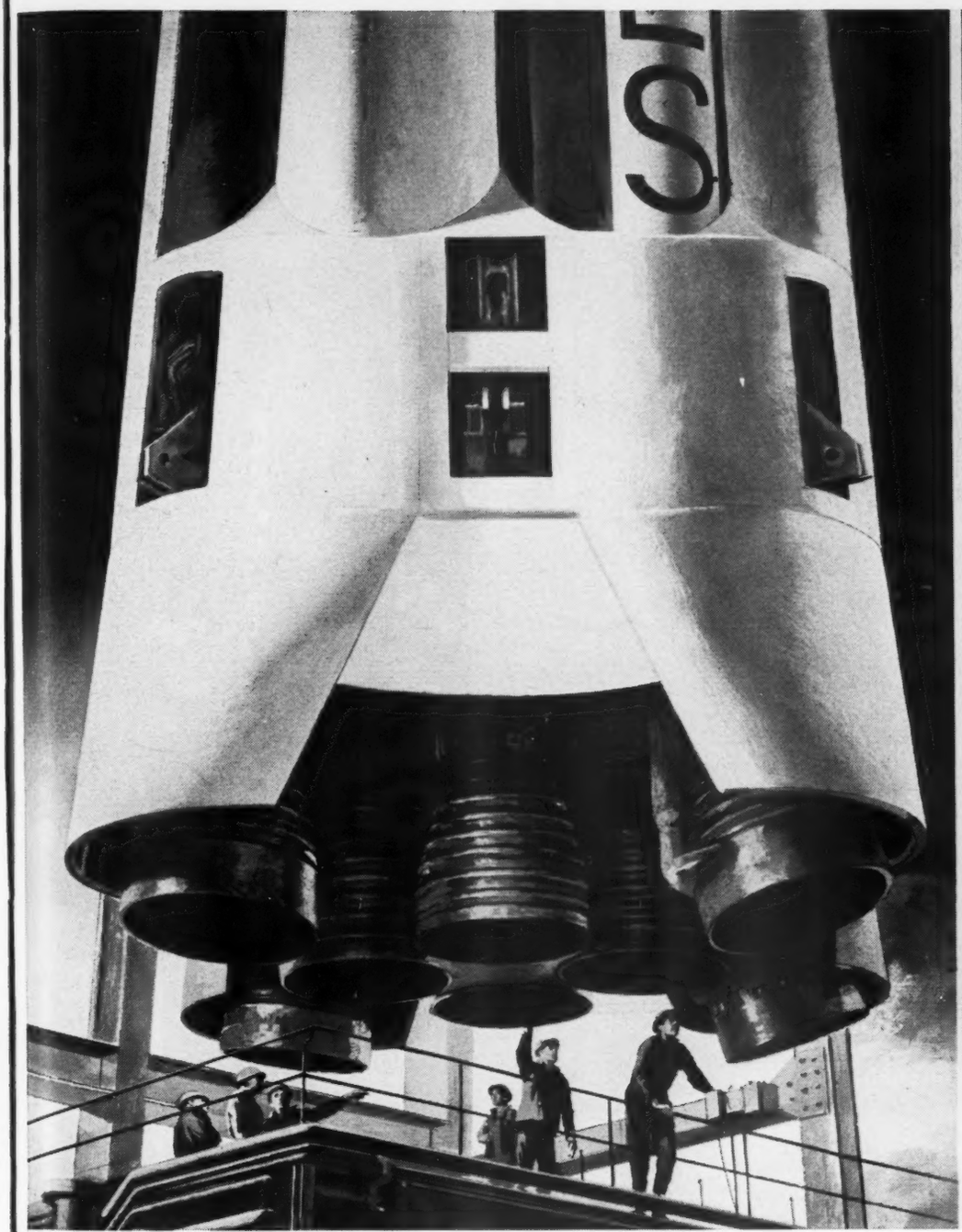


WHILE the public has become increasingly informed of the use of dogs, cats, rats, and monkeys in medical research, the use of some of our lower or more exotic forms of life in biological research gives rise to comments about their significance for human or Air Force problems. It almost seems as if some of this feeling harks back to our culturally old and deep-seated dread of lowly life forms. I am reminded of the fairies in *A Midsummer Night's Dream,* who sang:

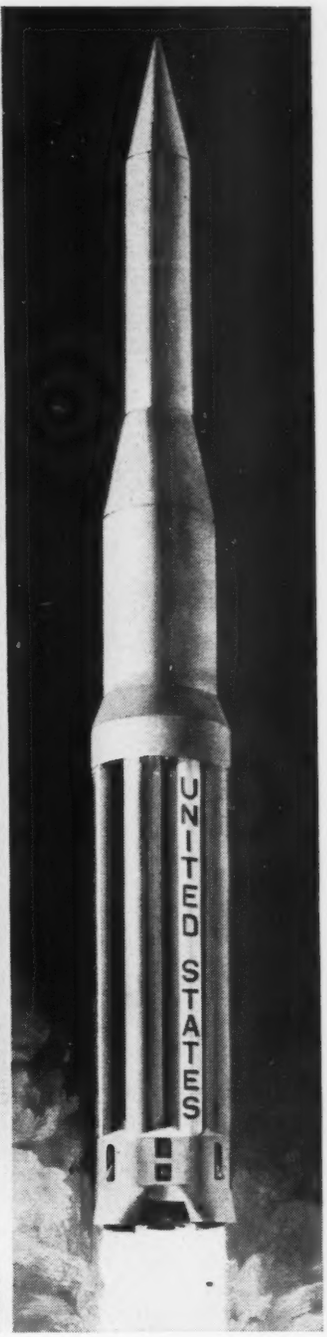
> You spotted snakes with double tongue,
> Thorny hedgehogs, be not seen;
> Newts and blind-worms, do no wrong,
> Come not near our fairy queen . . . . .
> Weaving spiders, come not here,
> Hence, you long-legg'd spinners, hence!
> Beetles black, approach not near;
> Worm nor snail, do no offense.

Thus, when scientists in the Air Force Office of Scientific Research report studies in which bats, beetles, electric fishes, octopuses, or bobolinks have been used, we are met with either tolerant amusement or slightly veiled ridicule, and in official circles, up to and including congressional levels, we seem to invoke incredulity, alarm, or special inquiry.

I am therefore reluctant to admit that our interests also extend to blind fish, waltzing mice, congenitally deaf cats, eels, ants, locusts, lizards, porpoises, crickets, scorpions, praying mantes, fighting fish, newts, spiders, and toads, to mention



The first version of *Saturn* will be 185 feet tall . . . 21 feet across the base . . . will contain 14 rocket engines!



Douglas-built second stage is as tall as a 5-story building.

The rocket that will lead the way to space travel is now in development

Space researchers at Douglas Aircraft are already working on the design and construction of the second stage of the huge NASA *Saturn* rocket.

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Future configurations of *Saturn* will have even greater thrust and payload, paving the way for round trips to the planets.

Fantastic as these predictions sound, they are the solid convictions of the men at Douglas whose skills have been behind the production of nearly 30,000 rockets, missiles and space vehicles. These include the *Thor* IRBM which has boosted more successful space payloads than all other U.S. boosters combined.

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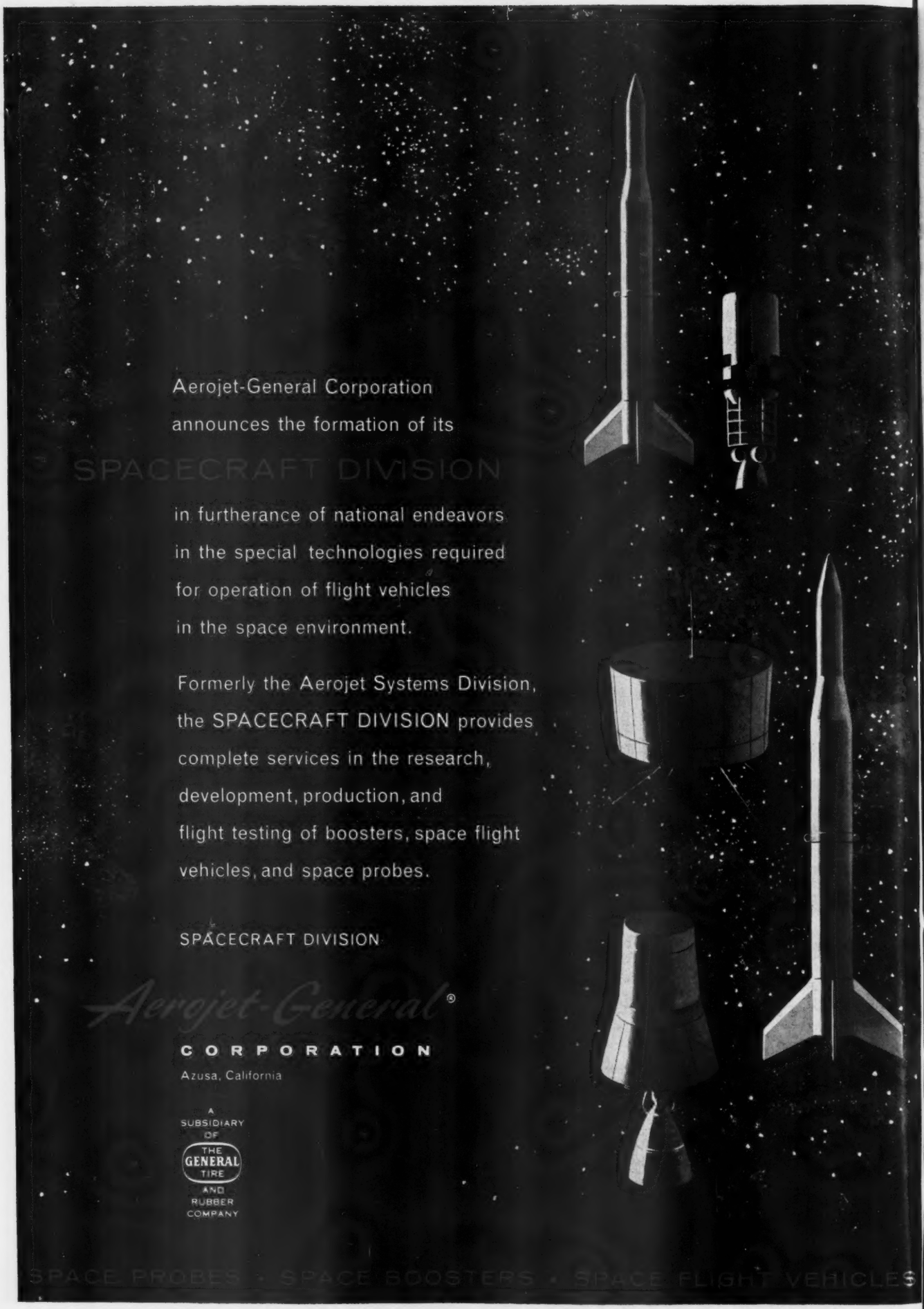
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only a few. But one thing we can be sure of, and that is that no one will be indifferent. Animals are familiar and provoke some response, be it protectiveness, acquisitiveness, gustatory anticipation, endearment, amusement, revulsion, or fear. I sometimes envy my scientists in physics, mathematics, and chemistry, who can report with relative impunity on the inanimate objects of their studies. Their reports are usually received with solemnity and respect, if not understanding. Paramagnetic resonance, neutrinos, magnetohydrodynamics, microwaves, excited states, Boolean algebra, ergodic theory, and intergalactic dust, are, after all, nothing to joke about, even if eyebrows may be raised occasionally over such things as Lie groups, pi mesons, Love's theory, Green's function on a Brown Space, or the backside of the moon.

Knowledge of the fundamental workings of the life process can have far-reaching military implications, as well as civil and humanitarian values. The improvements to be achieved in human performance and tolerance to stress are closely related to medical interest in control of disease and are well known. But less well known is the potential application of biology in engineering. Our physical scientists are making slow progress in building complex computer devices that can imitate the element of judgment characteristic of animal or human behavior. So far, machines can do what they are programed to do but can do little learning. Engineers now look with renewed interest on the ways nature has solved her control and communication problems. Nature has served as a vast laboratory for over two billion years and has made uncountable experiments. This vast evolutionary process has resulted in a fantastic wealth of animal types, many with unique and highly developed characteristics far beyond those of man. Therefore, I think it is of great importance to engineers that we are looking at all kinds of special senses in animals, and at the kinds of nervous control exhibited by even the simpler forms of life. The comparative approach to the solutions of biological problems has been a profitable strategy in the past and will undoubtedly be expanded as biology becomes a more quantitative and analytical science. I don't see how we are going to avoid getting tangled up in all this, as additional curious forms of life are brought under scrutiny.

A better understanding of man's behavior is recognized to be critical for the broad areas of selection, training, and efficiency. Since behavior depends upon differentiation within the central nervous system, the correlation of behavior with nervous activity should be as broad as possible and should not overlook the highly developed and stereotyped behaviors of certain species which may exemplify a relatively simple correlation between nervous structure and function. It should be far simpler to analyze the nervous system of an insect with a few nervous components than to tackle the intricate and frightening networks that comprise the nervous system of a rat or a monkey or man.

There is frequent talk that the manned bomber is obsolete, and those who won't believe this are immediately dubbed perpetuators of a "cavalry of the air." Missiles are all the rage. But the missile is a stupid beast. It only goes where you tell it to go. If you don't know where to send it, it is virtually worthless. A manned bomber is infinitely more versatile than a missile. But a missile operated by a computer that works like a man's brain would indeed make the manned bomber obsolete. And this, among other things, is what we are searching for in our biology basic research.

A dividend that can accrue from studies of diverse species is the derivation of models that can be the basis for development of useful electronic equipment. Despite the simplicity of their structure and the tiny mass of their essential components, these animals perform complex chores beyond the capability of the most sophisticated computers available today. An understanding and utilization of these biological principles can almost certainly lead to an increase in the versatility and a decrease in the size of future instruments. This is not to say that we would want to imitate the components of nature's systems, any more than our use of aerodynamic laws employed by the birds implies that we must build airplanes out of feathers. It is the laws of organization and information processing that we are most in need of. And if we get ideas for better components, that will be an added dividend.

Some of the implications and uses of animal sensing devices have already been reported elsewhere. For example, a mathematical model of

the beetle's vision is the basis for the development of a ground speed indicator. The use of ultrasonic cries for echo location by the bat is well known, if not yet fully understood. Its precision, speed, and freedom from interference make this a profitable system for study by the physicist, not only for military purposes but as an aid to the blind. The sensitivity of the moth's ear in intercepting hostile bat sounds surpasses that of our most advanced microphones. The sonar system of porpoises and whales has been little studied, but evidence indicates that they have a highly developed and accurate location sense combined with a high degree of intelligence and ability to communicate.

Other animal sensing devices are perhaps less well known but appear to the practical-minded to have equal potentialities. Many fish have electroreceptors which they use to detect obstacles. These fish emit pulses of low voltage with frequencies characteristic for each species. The frequencies may range from fifty to 1,600 cycles per second. The alteration of the pattern of the electric field as a result of objects, apertures, or other fish in the surrounding water can be detected. So sensitive is this response that the fish will respond to the movement of electrostatic charge produced by waving a comb (that has been run through one's hair) in front of the aquarium. They can differentiate between a conductor and a nonconductor or respond to the presence of a stationary magnet outside the aquarium. It has been calculated that these fish are sensitive to a change in field of the water around them of 0.003 microvolt per millimeter, a fantastically minute alteration.

The rattlesnake is equipped with exquisitely sensitive temperature receptors. These receptors will respond to an increase or decrease of 10^{-11} calorie (small) in 0.1 second, which represent a change in tissue temperature of 0.001° centigrade. Expressed in terms of a temperature quotient of Q^{10}, the frequency of nerve impulses in a single fiber is 10^{30}. When two balls of equal size differing minutely in temperature are presented to the snake, it will invariably and unhesitatingly strike at the warmer.

Certain insects have highly developed smell receptors. The antennae of male silk moths are highly sensitive to the odorous material produced by females of the same species, which they can detect at great distances. Hairs of various flies are amazingly sensitive to certain chemicals—some to salt, some to acid, some to alcohol. Spiders and some insects have mechanoreceptors by which they can detect minute vibrations, which they use for localization of prey or enemy. The lobster has a beautifully designed equilibrium sense organ which is sensitive to movement in various directions, to maintain position in one or another plane, and to vibration. The antennae of flies contain mechanoreceptors sensitive to a wide range of frequencies. This sensitivity permits analysis of each wing beat, with a delay of only one millisecond. The speed of flight is controlled by this sense organ. The flies long ago modified their back pair of wings into a vibrating gyroscope, which we are now trying to imitate.

The praying mantis integrates all the information it receives on the position of a fly, strikes and captures its prey—all within the space of fifty milliseconds. Bees use polarized light in returning to a source of nectar or to the hive. The visual accomplishments of certain birds are legendary; some use clicking sounds for echo locations. In the owl the shape of the head is related to a highly developed sound-locating system which enables the animal to pick up its prey in the dark. These examples could be multiplied almost indefinitely.

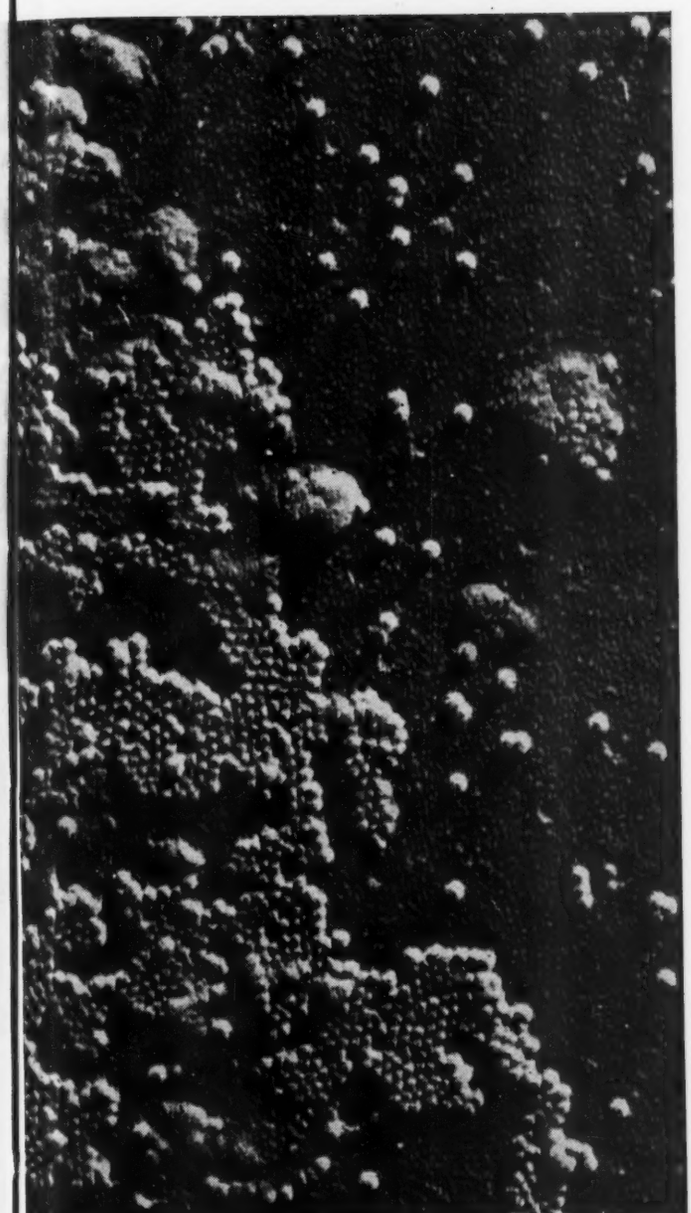
Some animals have receptors and sense organs which have been described anatomically but whose function is still unknown. Other animals are able to perform amazing feats—notably, the long migratory trek of birds—by mechanisms which are completely unknown to us.

I plead for patience with the Air Force biologist when he uses strange specimens of animal life. The wisdom and wonder of animal life have long attracted man. Let me remind you of the comments of the prophet Agur:

> There be four things which are little upon the earth, but they are exceeding wise;
> The ants are a people not strong, yet they prepare their meat in the summer;
> The cronies are but a feeble folk, yet make they their houses in the rocks;
> The locusts have no king, yet go they forth all of them by bands;
> The spider taketh hold with her hands and is in kings' palaces (Proverbs 30: 24-28).—END

Brig. Gen. Benjamin G. Holzman, now Commander of the Air Force's Cambridge Research Laboratory in Massachusetts, formerly was Commander, Air Force Office of Scientific Research. The above article, from Science, *September 23, 1960, is reprinted with permission.*

THIS IS ONE OF THE MOST IMPORTANT PICTURES IN THE HISTORY OF MANKIND



The virus of poliomyelitis, magnified 65,000 times by an RCA electron microscope. Photo by Dr. A. R. Taylor of Parke, Davis & Company.

This RCA electron microscope embodies all the many improvements born of more than twenty years' research and manufacturing experience.

Reproduced at the left is a photograph of the deadly polio virus—made visible for the first time with RCA's powerful electron microscope.

Viruses, one of man's deadliest enemies, could never be seen through ordinary microscopes. But with RCA's powerful electron microscope, scientists now can see them, study them, and learn how to fight them.

The electron microscope is *a thousand times more powerful* than ordinary microscopes. It can magnify an object 1,000,000 times. A pencil so magnified would be 119 miles long and 4 miles thick!

Today, this history-making "electronic eye" has a host of vital uses. In addition to its role in medical and scientific research, it has helped to make automobile tires wear longer, synthetic fabrics more durable and metals stronger. In fact, almost every product you buy is better in some way because of the RCA-developed electron super-microscope.

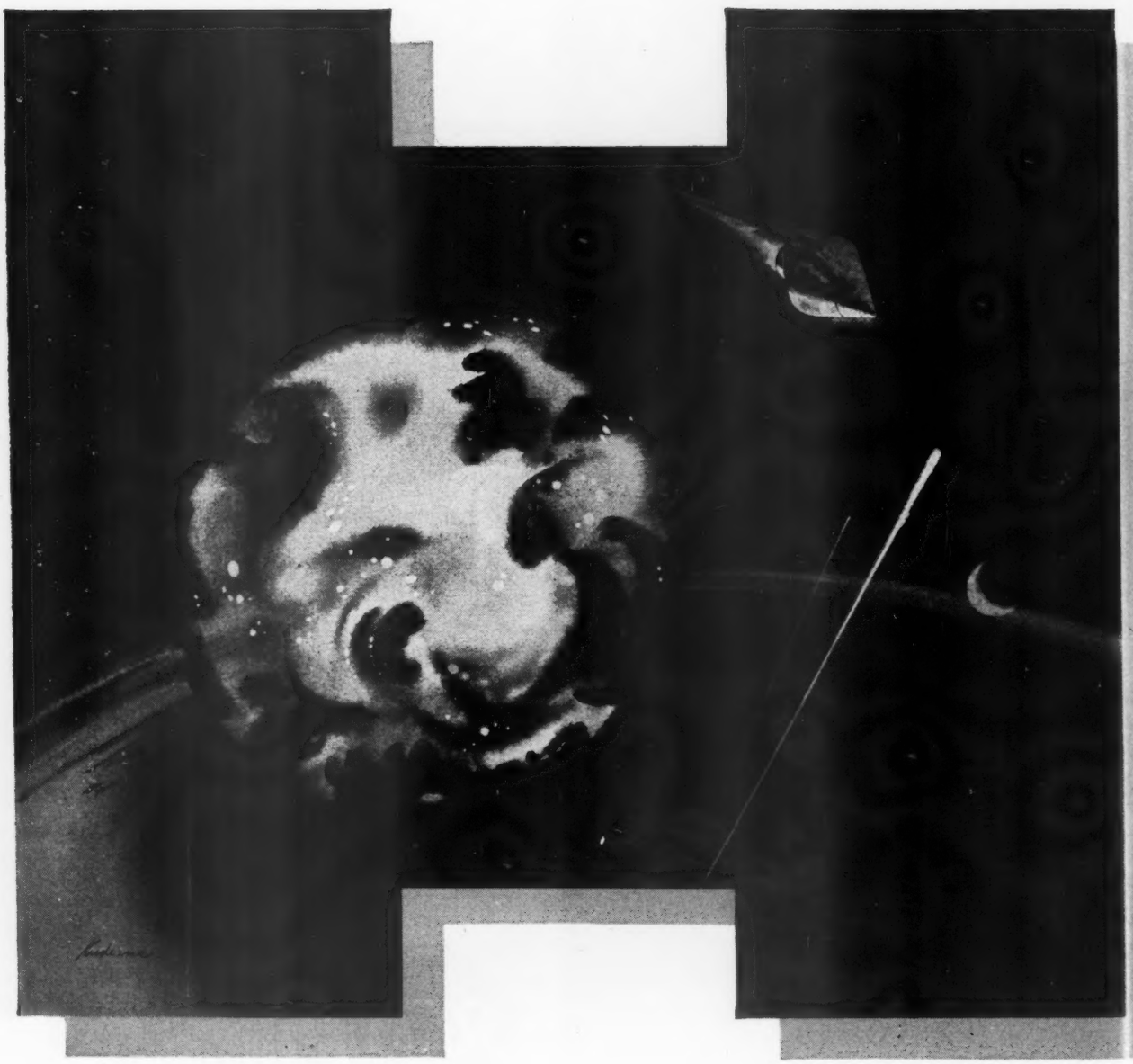
And now, so that many more may share its benefits, RCA has announced a long-term lease plan for its electron microscope. Interested? Write RCA, Industrial Electronic Products Division, Camden, N. J.

RCA skills and ingenuity gave man his first look into the world of the ultra-small. And these same skills assure the dependability of all the RCA Victor black-and-white and color television sets, radios, records and high-fidelity systems that you enjoy in your home.

RCA

The Most Trusted Name in Electronics

Ballistic missiles: the ultimate



weapon?

The ICBM is often called the "ultimate weapon." Yet, throughout history, there have been many so-called ultimate weapons. A defense has always been found.

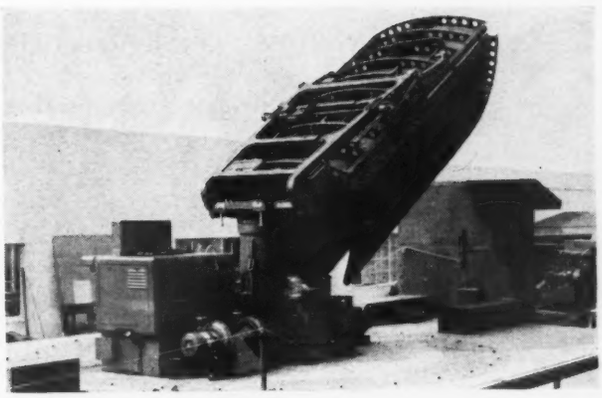
Today, Hughes engineers are studying this defense problem. Drawing on Hughes' past experience in the development of highly successful intercept systems, they are uniquely qualified to meet this challenge.

The high order of complexity in ballistic missile interception means that all of the traditional areas involved—early detection, discrimination, acquisition, tracking, data processing, intercept and kill—must be expanded to new highs in the state of the art.

Of tremendous help are the lessons learned during the development of the first successful airborne electronics intercept system—made up of the Hughes Electronic Armament System and Hughes Falcon air-to-air-guided missiles.

Hughes is also drawing on its skills in such fields as advanced infrared and radar detection systems, satellite communications systems, electronic scanning radar systems, space vehicle technology, microwave propagation, advanced data handling and display systems, and other fields of advanced electronics.

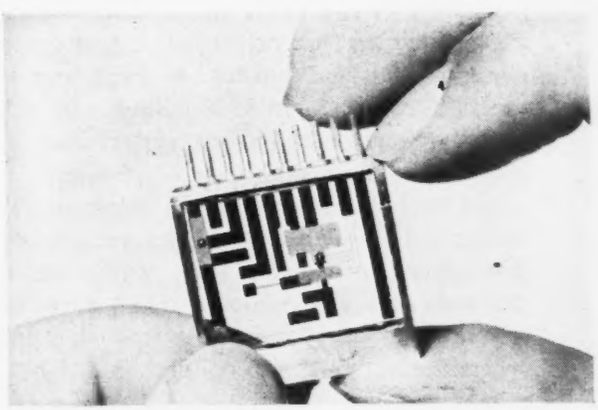
Hughes Anti-ICBM work will be coordinated to combine the efforts of virtually every Hughes activity. In this way, every conceivable idea can be studied—and the entire spectrum of electronics broadened.



This Hughes three dimensional radar antenna, *shown in the process of retraction, is completely mobile. Working with mobile data processing systems, this antenna provides umbrellalike protection for key defense areas.*

Foresight and imagination, plus tested and proven management capability — these are the factors responsible for the success of Hughes systems.

For further information — particularly about Hughes' capabilities in the Anti-ICBM area — please write: Hughes Advanced Program Development, Marketing Department, Hughes Airborne Systems, Culver City, California.



This complete flip-flop circuit *demonstrates Hughes' capabilities in the field of solid state data processors. To broaden the state of the Anti-ICBM art, Hughes is drawing upon a great number of advanced electronic techniques such as this.*

Creating a new world with ELECTRONICS

HUGHES

HUGHES AIRCRAFT COMPANY
Culver City, El Segundo, Fullerton, Newport Beach, Malibu, Oceanside, Santa Barbara and Los Angeles, California; Tucson, Arizona

Even with its high costs and innumerable problems,
the potential yield of space technology
encourages a resounding answer of yes to the question . . .

ARE SPACE PROBES WORTH IT?

LLOYD V. BERKNER

"SITES Mapped for Bases on Moon," "Suborbital Flight by Astronaut Due This Year," "Echo I Relays Voices Coast to Coast," "US Recovers First Capsule from Orbit," "Soviets Bring Back 'Noah's Ark' Chamber." No month—and hardly a week—goes by without more news about man's trials and triumphs in the world of space.

In the five years since President Eisenhower's announcement of the United States space program on July 28, 1955, we have learned much, and not the least important fact is that space exploration will be expensive. In 1959, our space program cost us almost $500 million, and in 1960 it is expected that military and civilian space activities will cost more than $1.15 billion.

Are such huge expenditures worthwhile? Although it is true that we cannot yet predict the full returns to mankind that will come from thorough space exploration, we can already perceive very substantial rewards from our present program. Our space expenditures should be considered a capital investment, like the construction of a great factory from which will emerge profitable products in the future.

In many respects, the situation is parallel to the system of subsidy that was necessary for the aircraft industry thirty years ago. Such subsidies made possible the creation of a new industry which not only provided us with the benefits of fast transport between any points on earth, but created employment, new sources of tax revenue and new and challenging opportunities for businessmen. At the moment, many of us do not realize that a similar situation exists with respect to space.

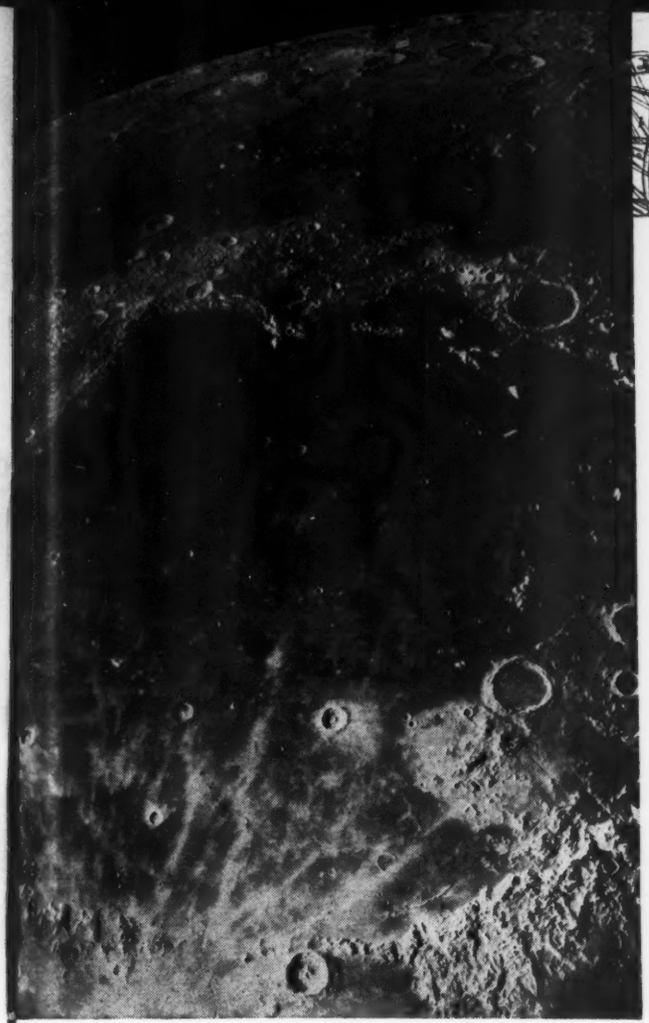
The practical potentialities of space exploration are sharply punctuated by the development of our capability to recover space vehicles on earth. The success [in August] of both the US and the USSR in returning space vehicles safely marks a major step toward ease in all aspects of space operations in the future. The ability to return vehicles with safety will increase the payoffs to be anticipated from our space program in military, commercial, and particularly in scientific applications of space activity.

Just what rewards can we expect from space? Each field of research has its hopes and has its attendant hazards. These are some of the payoffs and problems:

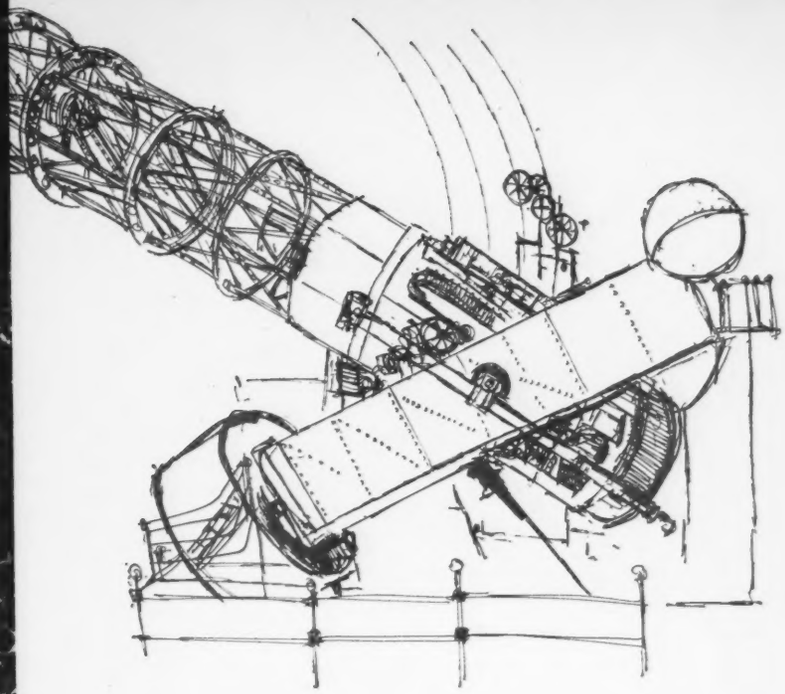
The most promising military application of space vehicles is the reconnaissance satellite. Already the first craft has been launched to develop this capability. A half dozen such devices, in appropriate orbits about 300 miles above the surface, could scan during sunlight hours every point on the earth daily. If it were not considered necessary to cover the whole earth, a smaller number could do the job. The nation possessing them would have an immense defensive advantage.

Even with present techniques, it is reasonable to expect that surface objects about 100 feet across could be distinguished in the pictures sent back by a reconnaissance satellite. Radar would enable it to observe large movements, as of troops or airplanes, even through clouds.

It could also eavesdrop on communications



Yesterday's science fiction is tomorrow's possibility. Manned landings on the moon, which is already being studied in terms of site-mapping, are among the dramatic likely feats to come.



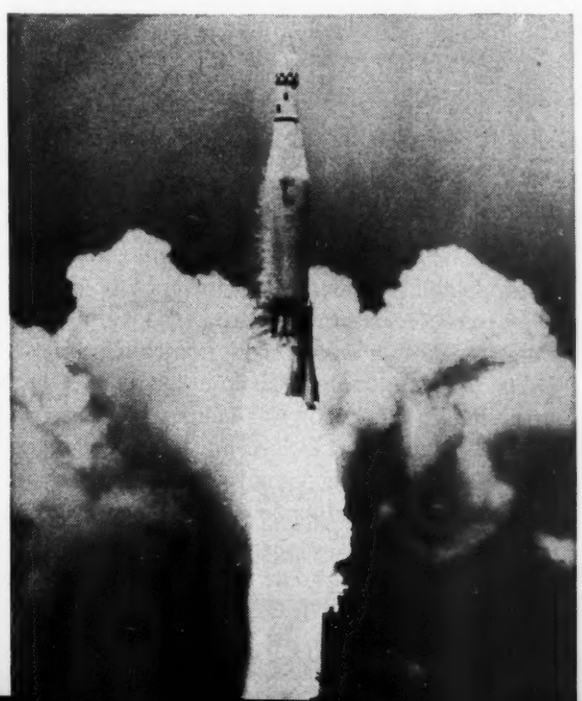
carried on at such very high frequencies that they cannot be received over more than a limited surface distance. Indeed, the quantity of communications information that can be acquired in this way is so great that a special problem will arise in handling the data collected, so that only useful information will be sorted out.

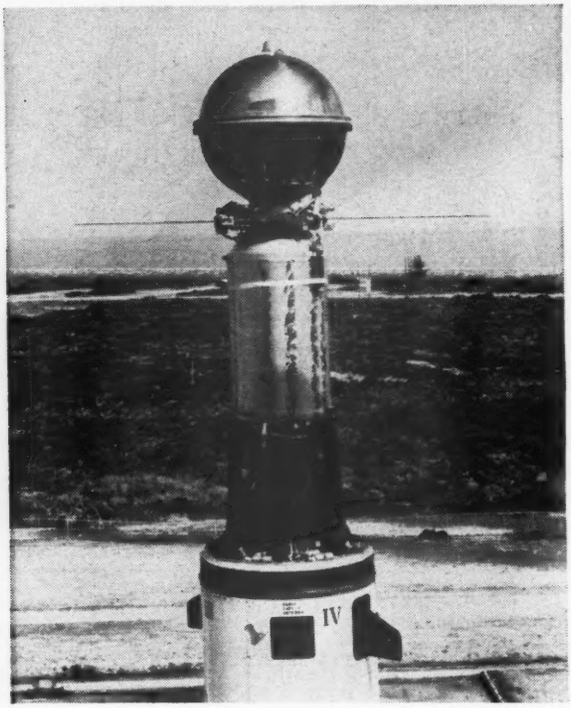
A special application is the twenty-four-hour satellite. This is one launched in such a way as to orbit at the same rate as the earth revolves. Thus it would appear to remain stationary (or to swing very slowly in an arc) over one spot. Here, truly, "Big Brother is watching you." Such a satellite could be used not only for reconnaissance, but to broadcast television and radio programs into another nation's territory. Jamming such broadcasts could be accomplished only by another satellite.

Obviously, overflights by reconnaissance satellites will raise serious problems in international relations. We consider that space begins about 100 miles above the earth's surface, but how far do a nation's territorial rights extend? If a nation considers an overflying or hovering satellite inimical to its interests, it will be impelled to take countermeasures to reduce its effectiveness, or to destroy it. Thus the possibility of a space war arises, unless agreements among nations avoid the creation of friction in this way.

There is a more reassuring aspect to the use of reconnaissance satellites. By providing dependable data to show that a nation was *not* preparing an attack, they could conceivably quiet the nerves of a troubled world in a time of crisis, and so help to avert a war.

Military potential of space technology—as a method of early warning and reconnaissance—is symbolized by May 1960 launch of the Midas II test vehicle, forerunner of space defense tools.





Primitive but effective demonstration of feasibility of communications via space was Echo balloon satellite, launched by USAF for NASA in August 1960. Here shown prior to launch is the sphere, which contained aluminized balloon atop booster.

To reach these goals, however, costly development is required. Instruments are still primitive and great advances and repeated tests will be called for. Much experience will be required to evaluate and comprehend the information telemetered back to earth.

Space activities promise to revolutionize communications—radio and television, telephone and teleprinter messages, wirephotos and radiophotos, and the like—to such an extent as to produce a whole new industry.

The number of radio channels suitable for long-distance communications by present methods is very limited. Cables can be used—across both land and oceans—but these also have limited capacity, and are very costly.

Communications by means of suitably oriented and instrumented satellites promise to change this situation entirely.

We have just seen the first such experiment, with the launching of an inflated, 100-foot metallic-coated balloon from which radio signals, sent from a highly directional antenna, can be reflected, or bounced to a distant receiver. The system will make very high frequencies—now normally confined to short-distance uses, such as television and car telephones—available for long-distance communications.

The simple reflecting sphere is but a beginning. A twenty-four-hour, or hovering, satellite, equipped with a solar or nuclear power supply and a relay transmitter, could increase the present communications capacity between two distant points a hundredfold. A hundred such satellites properly placed would increase our worldwide communications capacity by a factor of 10,000.

Intercontinental radio and television networks are elementary examples of the applications of space communications that should be available in the next decade or so. Worldwide telephone dialing will become possible. Message costs will be cut to perhaps one-tenth their present levels.

Whole new systems of international communications will doubtless appear. One can imagine a plant manager instantly ordering materials from anywhere in the world, with detailed specifications communicated automatically.

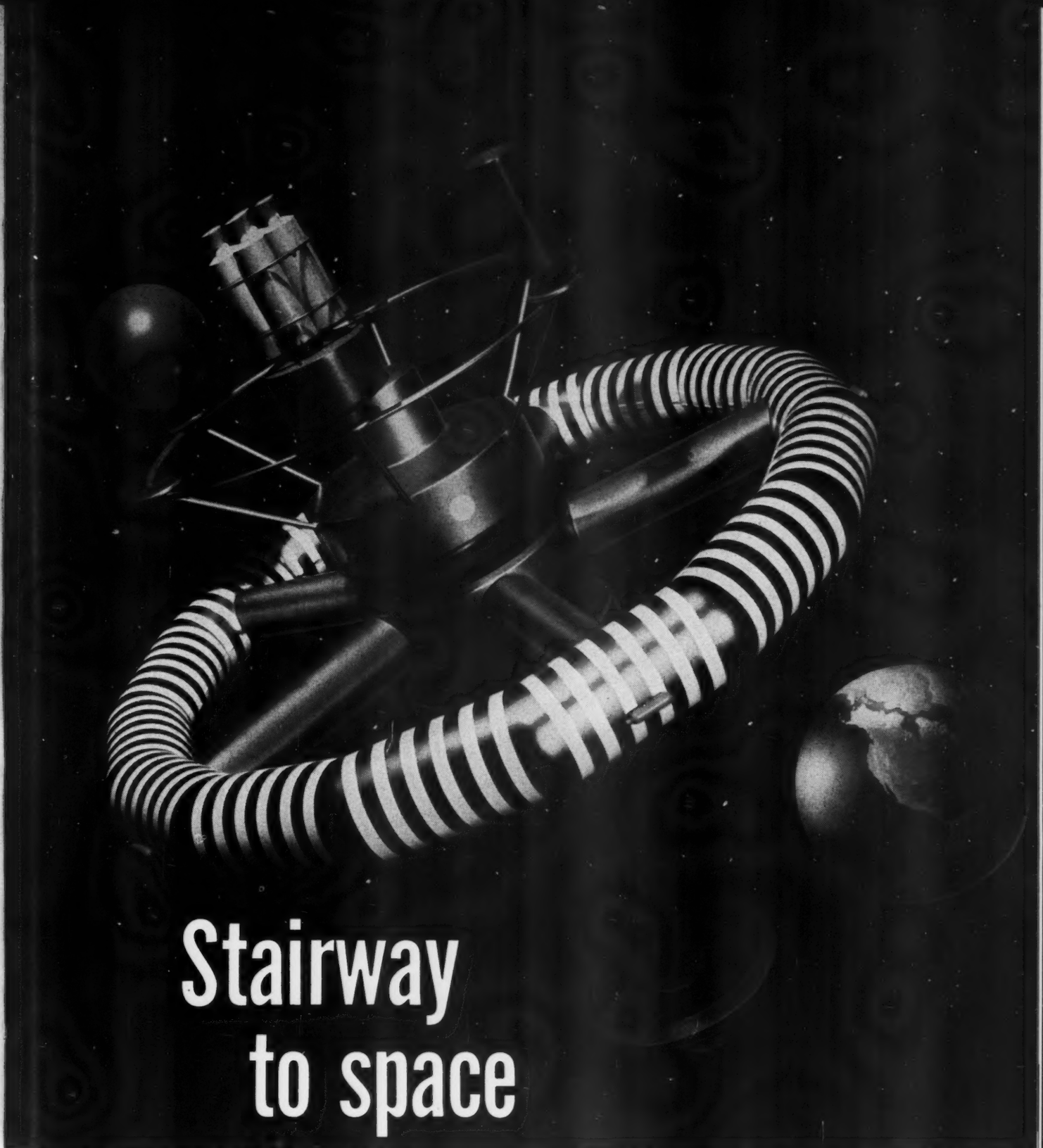
Indeed, the remote operation of automated machines in accordance with predetermined specifications seems entirely probable. Beyond lie applications in forms we cannot now even visualize, but we can be sure that they will bring peoples closer together and create enormous industrial opportunities.

Again, a heavy expenditure of effort will be needed. Component parts of electronic circuits must reach quite new levels of reliability to last for ten or twenty years in continuous operation on station. Even our largest present rockets could not place a heavy relay satellite in twenty-four-hour orbit, and we must await the Saturns and Novas that are now being developed.

To acquire this communications capability—with the industry and employment and other advantages that it can provide to mankind—will require the development of an intricate system of international agreements and controls.

For example, there must be agreement on the transmitters and receivers to be used. Frequencies must be allocated in detail to avoid interference among satellites or with the present short-range users of high frequencies. There must be controls to prevent commercial warfare in the form of jamming signals that would render satellites useless.

The International Telecommunications Union, an affiliated agency of the United Nations, provides a basis for such agreements. At its regular decennial meeting in Geneva last year, the ITU called a special session on space communications



Stairway to space

Sometime in the 60's, America may have a manned station in space—and it could look a lot like this scale model by Lockheed.

We have much to learn before it can be built. Research is our stairway to space—basic research that seeks to discover the new rather than develop the known. We cannot predict what such research will discover, or when—but we delay it or curtail it at our peril.

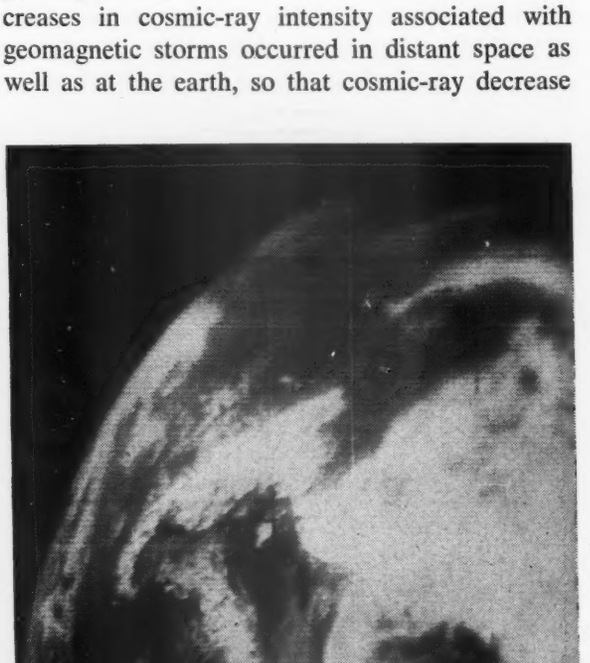
Today, at Lockheed's Missiles and Space Division, more than 5,000 scientists and engineers are engaged in one of U.S. industry's broadest research and development programs. One group is conducting private industry's largest, most diversified program of fundamental research in space physics. Already they have made massive contributions to America's space technology—particularly in the Discoverer, MIDAS, and Samos satellite programs of the U. S. Air Force.

LOCKHEED MISSILES & SPACE DIVISION

for 1963. Already a work group of the agency has begun studies to see how the world can deal with these revolutionary problems. Within the United States, the Federal Communications Commission has announced hearings to review and evaluate the new problems that space communications impose.

The immense advances in science brought about by space research were clearly evident at the assembly of the International Union of Geodesy and Geophysics at Helsinki, Finland, early in August. Illustrative of these advances were the accomplishments of Pioneer V.

As it left the earth, Pioneer V found a third belt of electrification encompassing the earth 50,000 miles above its surface. Farther out, this great rocket found that interplanetary space was permeated by a small but significant magnetic field. Then, following an eruption on the sun, it encountered a dense cloud of ejected solar particles carrying with it a strong magnetic field. As this cloud reached the earth it caused a severe geomagnetic storm. This rocket showed that decreases in cosmic-ray intensity associated with geomagnetic storms occurred in distant space as well as at the earth, so that cosmic-ray decrease is an interplanetary phenomenon and not a geocentric phenomenon.



Weather prediction and possibly even weather control are potential payoffs of space technology, as foreshadowed by Tiros II, NASA weather satellite, launched in April 1960. This photo, relayed by Tiros, is of cloud cover over the Alps.

From data like these observed in space, together with the IGY observations on earth, the scientists at Helsinki pieced together an exciting and coherent picture of the earth's interplanetary environment, and of the mighty influences of a stormy sun in producing important effects on the earth. Where will this new knowledge from space lead us?

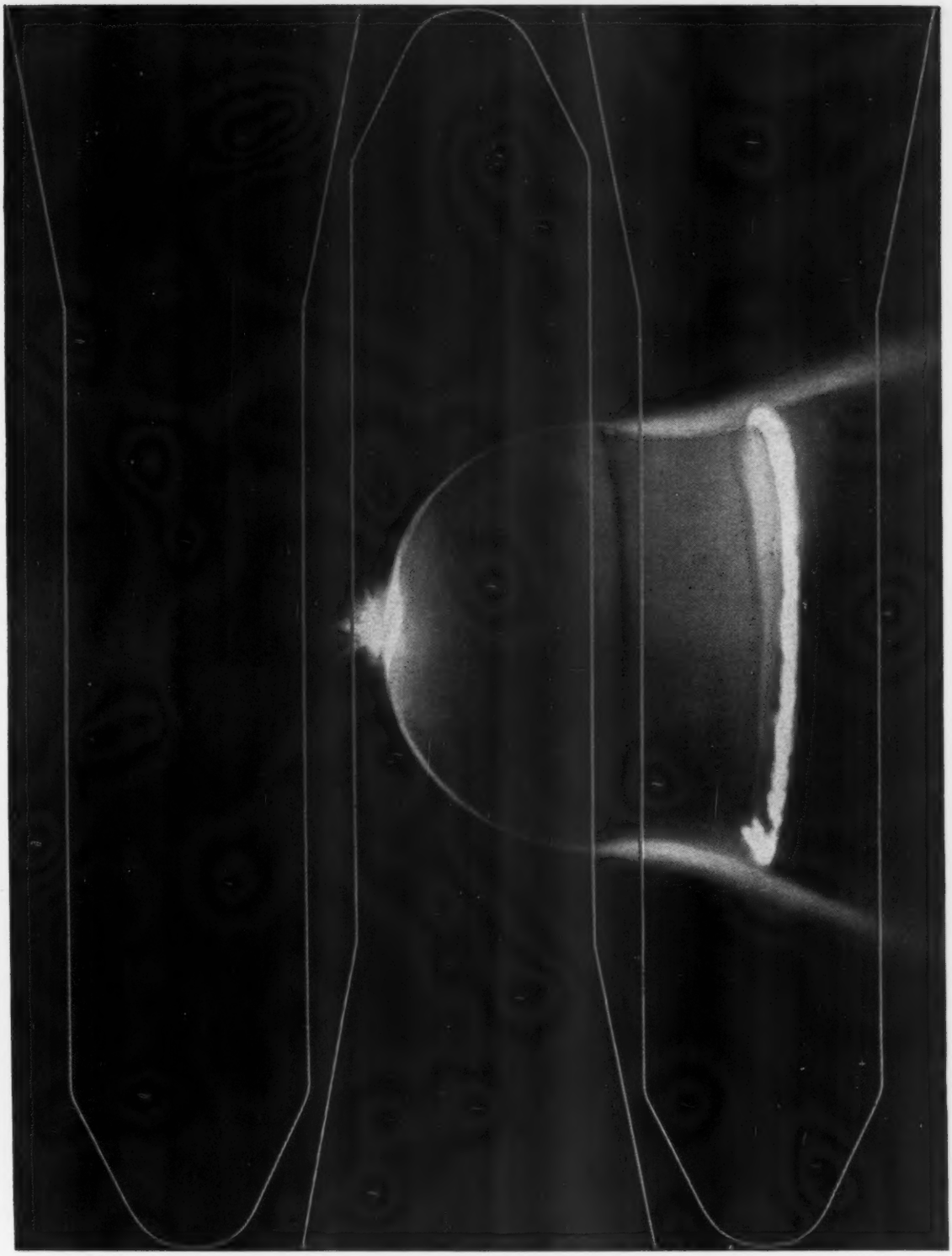
Let us consider, as an example, the benefits of space research in meteorology. At present, weather forecasts can be made with reasonable reliability only about forty-eight hours in advance. If we could extend our forecasts only a little, the monetary gain would be enormous.

A representative of the American Petroleum Institute recently remarked that a knowledge of climate only a few percent more reliable than we have might save oil companies $100,000,000 a year, since they would know in advance where to ship their oil and could cut inventories elsewhere. In one way or another, almost every aspect of human activity is affected by the weather, affected in terms of actual costs of operation.

How can satellites increase the accuracy of our forecasts? One way is by observing and mapping variations in the earth's cloud cover. We know that clouds reflect back into space ten to twelve percent of the sun's heat which otherwise would reach the earth's surface. Since it is this heat that warms the atmosphere and powers the terrestrial heat engine that gives us winds and storms, variations in the cloud cover have a profound effect upon our weather. But we do not yet know how, when and to what extent these variations occur.

The primitive experiments now under way, such as the many cloud photographs taken by the satellite Tiros, indicate that we are on the threshold of unimagined advances in our knowledge of meteorology. In the long run, increased understanding of climatic trends may prove more important than improvements in day-to-day forecasting. Man's earthly environment changes constantly. After all, New York was in the grip of an ice age probably not more than 20,000 years ago, hardly any time in geologic terms.

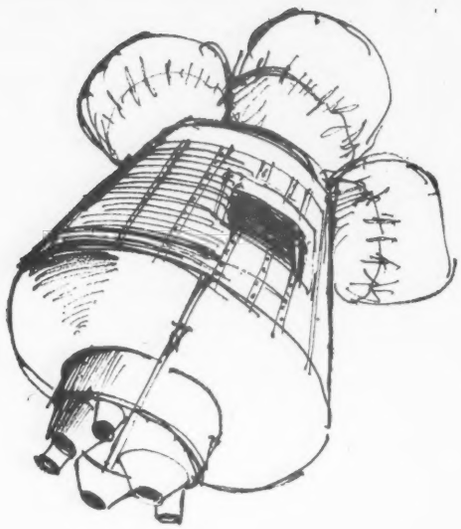
We do not yet know, although we should, what will be the ultimate effects on our environment of the simple activity of burning up the earth's fossil fuels—coal and oil—and discharging the resulting carbon dioxide into the atmosphere. Improved knowledge of meteorology has an enormous bearing on mankind's welfare in the future.



Blasting new materials to make missile nose cones. The first ICBM nose cone ever to be recovered after flight was protected by a new, high-temperature material. Its name: Avcoite. Its construction: specially reinforced ceramic. Avcoite was the first of a family of new heat-shielding materials. They were developed for re-entering nose cones and satellites by Avco's Research and Advanced Development Division. Newest addition to this materials family is Avcoat, a plastic heat-shield here ablating smoothly in a hydrogen-oxygen jet simulating satellite re-entry temperatures.

Avco

AVCO CORPORATION, 750 THIRD AVENUE, NEW YORK 17, NEW YORK



Astronomy offers another example of how space activity can pay off in terms of scientific research. Satellite-borne telescopes, outside the earth's atmosphere, will show the heavens with new clarity. From these studies, it seems likely, we shall learn not only much about the origin and character of the universe, but also new information about the basic physical processes of things about us.

Finally, space exploration will extend to the moon and planets. The first steps will be taken by placing a man in orbit around the earth and bringing him back—Project Mercury. A suborbital test flight is imminent, probably before the end of the year. Then will come visits to the moon made by unmanned craft equipped with instruments to study their targets as they circle them, and radio their findings back to earth. Next will come unmanned vehicles that can be landed, made to gather samples of the surface, and relaunched to return to earth; and, at length, manned vehicles.

Certainly, landings of instruments on the moon to relay back information will be possible within three or four years. But to take man out, to give him protection, to equip him for useful work and to return him will require at least a decade.

The foreign-affairs problems in the scientific space field are fourfold. First, there is the need for international cooperation in tracking and communicating with space vehicles. Not only must there be observation stations in different countries around the globe but there must be agreements to clear specific radio channels for space use.

Second, there must be agreements for the exchange of data received from satellites, and of the codes whereby they can be "read." Clearly, scientists of a nation cooperating in the collection of data will want to share in their interpretation.

Third, scientists of nonlaunching nations must be given access to space. Agreements permitting them to use facilities aboard space vehicles for their own experiments are necessary if we are to avoid envy and hatred—and if we are to advance science by drawing upon the best men, regardless of nationality.

Fourth, international agreement on the biological decontamination of space vehicles is of the utmost importance. If there is life on other planets, even in the most elementary forms of viruses or bacteria, it is vital that it be identified without any confusion introduced by bringing earthly forms of microorganisms.

Fortunately, international scientific cooperation in space dates from the very beginnings of space activity, under the International Council of Scientific Unions, in the organization of the International Geophysical Year. It is being continued in the work of a worldwide group known as the Committee on Space Research (COSPAR), which held its first international symposium on space science in Nice in January of this year.

The United Nations, too, is working in this field through its Committee on the Peaceful Uses of Outer Space. The first UN International Conference on Outer Space is to be held sometime next year. Out of these discussions can come intelligent planning for the necessary steps toward international cooperation and agreement.

These are some of the payoffs that we can expect from a solid program of space research. Without international controls on the use of space, however, the possibilities for good will become sources of serious international tensions—possibly even of space war.

For the moment, we have a period of respite while nations develop new and more sophisticated forms of space activity. We must hope that the nations use it for serious discussions leading to agreements that will enable space research to exploit its exciting opportunities and benefit all mankind to the full.—END

Lloyd V. Berkner, an original proponent of the International Geophysical Year, is chairman of the National Academy of Science's Space Science Board, and president of Associated Universities, Inc. Above is reprinted with permission from the New York Times Magazine, *where it appeared on August 28, 1960.*

WESTINGHOUSE CAPABILITIES FOR DEFENSE

Fastest airborne digital computers

Westinghouse Electric Corporation continues to make significant advances in computer science with the versatile new WDP-167 airborne digital computer. This computer performs 167,000 mathematical operations per second. Each operation includes two memory cycle times plus arithmetic execution time.

The surprisingly small WDP-400 computer, now in development, will perform 400,000 operations per second.

Both are general purpose computers for advanced applications in such fields as radar detection, defensive systems, space guidance, satellite tracking, missile and fire control.

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Cooper Development Division to Centralize Operations in Van Nuys

In the next few months the entire Cooper Development Division will move to the Van Nuys headquarters of The Marquardt Corporation. By concentrating aero/space operations in one centralized, fully equipped facility, the full capabilities of Cooper can be better focused on the technological problems facing government, industry, and private research groups.

Cooper Development Division will be in direct contact with extensive testing facilities and the combined experience and knowledge of the Power Systems Group and the ASTRO Division. Power Systems Group maintains an outstanding reputation in advanced rocket engine concepts, fuels and propellant research, high temperature materials development and experimentation, and advanced manufacturing techniques. A close working relation with the ASTRO Division will provide a nationally recognized source of basic and applied research information as it pertains to CDD's operations.

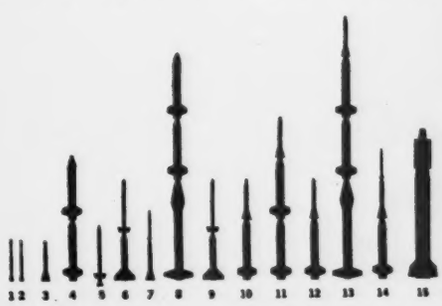
CDD, located in Monrovia, California when acquired by Marquardt in 1958, provides complete and proven high altitude rocket research services. These high altitude or space probe systems are designed for wind measurement; meteorological, radiation and biological information; and similar military and scientific high altitude aero/space programs.

CDD supplies a complete project service—from design, development, and production to field testing and data evaluation—for rocket research systems. Now with immediate access to larger testing and manufacturing facilities and directly supported by Marquardt's more than fifteen years of comprehensive experience in the propulsion field, CDD can offer their customers broader, faster problem solutions on an even more competitive cost basis.

Detailed information covering Cooper's experience, capabilities, products and services may be obtained by writing A. B. Metsger, Vice President-General Manager, Cooper Development Division, The Marquardt Corporation, 16555 Saticoy Street, Van Nuys, California.

Engineers and scientists experienced in aero/space activities are invited to acquaint themselves with the outstanding career opportunities in the field of rocketry at The Marquardt Corporation.

The Cooper Family of Rockets



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Speaking of SPACE

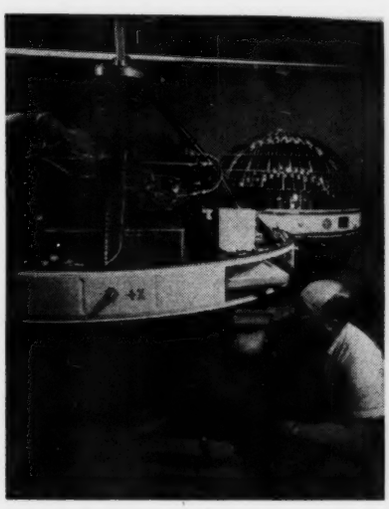
WILLIAM LEAVITT
Associate Editor

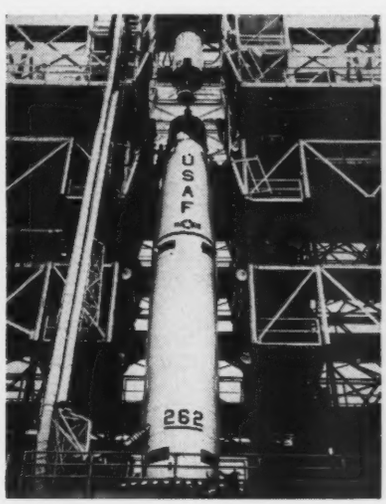
Losing Face on Man in Space

"Congressional intent should be made clear that in supporting an expanded effort in the life sciences, the Executive Branch is expected to carry out this expansion with adequate protection of our existing facilities and personnel against unnecessary duplication, or unused capacity which is still needed. However, the nature of much of this life-sciences research is such that no single laboratory or organization should have an exclusive right to pursue these efforts if we expect maximum progress. There is room for such work to be conducted by the National Aeronautics and Space Administration, the armed services, and many other institutions. We must at the same time provide for adequate interchange of information and share the use of facilities and personnel so as to advance the national program with the greatest speed and economy. The committee bears in mind the particular responsibility which NASA has for taking the initiative in formulating a national program and in seeing that it is executed regardless of where the work is done—in-house, in other government laboratories, or by outside contract."

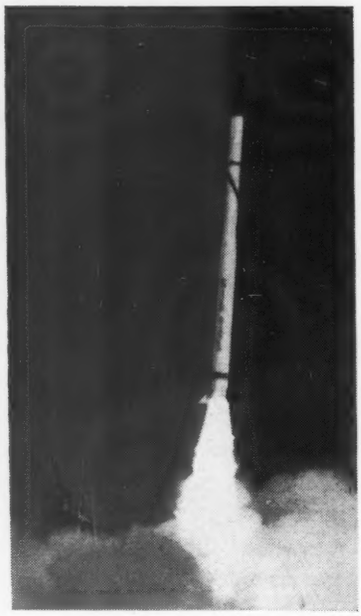
The above lengthy quotation is from the recently released Report on Life Sciences and Space, issued by the House Committee on Science and Astronautics, on October 4, the third anniversary of Sputnik and the day the United States happily marked with successful launch of its Courier communications satellite and NASA's "economy rocket," the Scout.

The bland language quoted from the House report, which elsewhere slaps NASA's wrist for asking for life-science facilities of its own without candid explanation of how it will avoid duplication of existing capabilities in this vital and under-





US space technologists celebrated October 4, third anniversary of Sputnik, with successful launch of 500-pound Courier communication satellite into inclined-to-equator orbit from Cape Canaveral, Fla. Courier package (left) was developed by US Army Signal Corps and Philco, and launched by (center) an Air Force Thor-Able-Star rocket. Known as a "delayed repeater," Courier, powered by solar cell, relays stored messages on radio command from earth. At right, teletype being monitored by Army Research Director, Dr. Richard S. Morse, displays the message which has been relayed back to earth.



October 4, Sputnik anniversary, also was date of launch by NASA of Scout rocket from Wallops Island, Va. Launching marked the first successful firing of a four-stage, solid-fueled rocket under full guidance and control. Nose-cone hitchhiker was radiation counting equipment supplied by the Air Force.

staffed area of astronautics, is an interesting study in the frustration that attends investigation of, let alone *action* in, the space medicine field—the *sine qua non* of manned spaceflight.

For two crowded, stuffy days last June, the House Space Committee heard a distinguished parade of military and civilian witnesses expound on existing space-medical capabilities within the military services and the announced plan of NASA to set up its own Office of Life Sciences. It was the announcement by NASA of that intention which stimulated the Committee hearings, since many observers had taken exception to what they considered a further splintering of an already fragmented effort.

During the two days of hearings, reports on military capabilities, notably in the Navy and Air Force, were submitted, while the NASA representative devoted most of his testimony to NASA's desire to build a capability of its own, which he assured the committee would not conflict with existing capability in the Department of Defense.

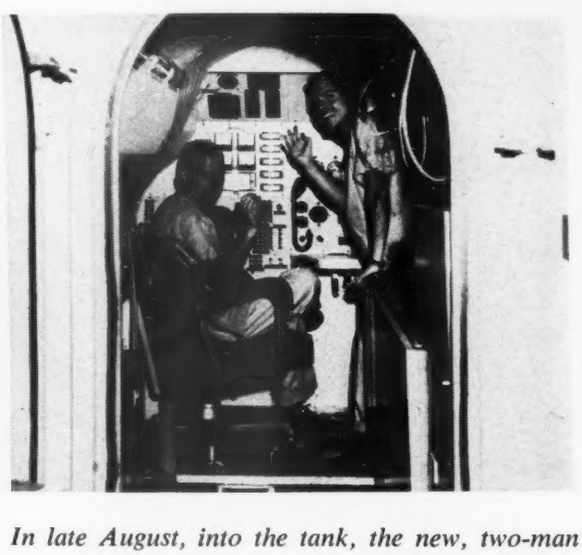
The sharpest questioner during the two-day hearings was Rep. Emilio Q. Daddario, Democrat of Connecticut, who feels strongly that it would make more sense for NASA to submit its medical requirements to existing military laboratories, rather than building up a large capability of its own.

The Connecticut congressman kept hammering away at military witnesses with the same question: Did they see any conflict between NASA's life-science plans and existing military capabilities?

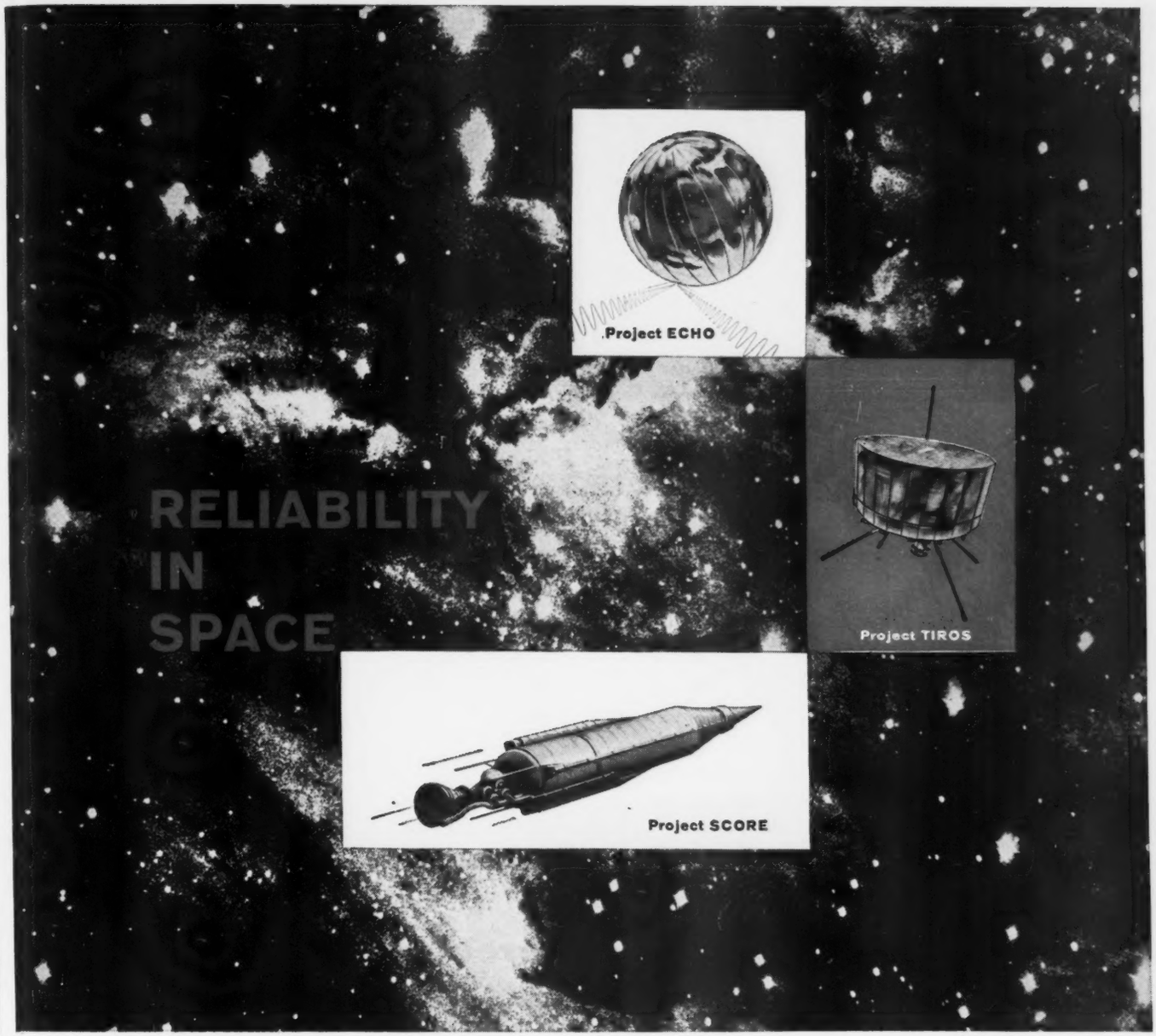
The answer—and one could almost feel the tug of the White House and its implicit proscription against stressing the military involvement in the space effort—was always no.

NASA's life-science plans, as presented to the Committee, involve—in addition to the gathering of a qualified staff and the sponsoring of contracted research—the creation of a life-science

Air Force Association Convention-goers and newsmen at San Francisco in September saw this first released USAF artist's conception of the Dyna-Soar manned space glider, as it would appear at the moment it separated from its Titan ICBM booster and entered its suborbital flight pattern.



In late August, into the tank, the new, two-man space-cabin simulator at the Air Force's Brooks AFB, Tex., go Capt. William D. Habluetzel and Lt. John J. Hargreaves. There they stayed for thirty days, while space medical researchers watched them on television for their reactions.



In satellites and ground equipment, RCA space systems set outstanding performance record.

With its third consecutive satellite success, RCA Astro-Electronics Division has made "reliability" meaningful in space systems engineering and development. Read the "Reliability Record" for yourself.

December, 1958: Project SCORE. AED developed the communications and control systems for the U.S. Army Signal Corps' "Talking Atlas", part of a program under ARPA, Dept. of Defense. Transmitters, receivers and control units in the satellite and at the ground stations all operated perfectly as the "Talking Atlas" broadcast the President's Christmas message and proved the feasibility of active communications satellites.

April, 1960: TIROS I. The sophisticated satellite, including its structural design as well as the electronic systems, and its ground stations were developed and built for NASA by AED under the technical direction of the U.S. Army Signal Corps. It accomplished its mission in meteorological observation, sending down over 20,000 TV pictures of earth and its cloud cover.

August, 1960: Project ECHO. The only electronic equipment on this 100-foot balloon, launched by NASA to prove the feasibility of passive communications satellites, are two "dinner plate" beacon transmitters 10 inches across by ⅜ inch thick, including storage batteries and solar cells. These units, designed to permit beacon tracking of the satellite, weigh only 11 ounces apiece and were developed and built by AED.

As more and more sophisticated space systems are developed, AED will continue to design for reliability in this most demanding of all environments. To find out how you can draw on this dependable R&D capability, contact the Manager, Marketing, RCA Astro-Electronics Division. If you are interested in participating in this challenging team effort, contact the Employment Manager, Astro-Electronics Division, Defense Electronics Products, at RCA's "Space Center" in Princeton, N. J.

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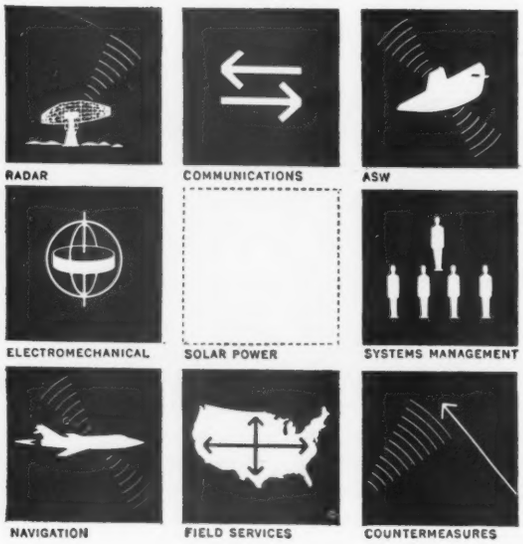

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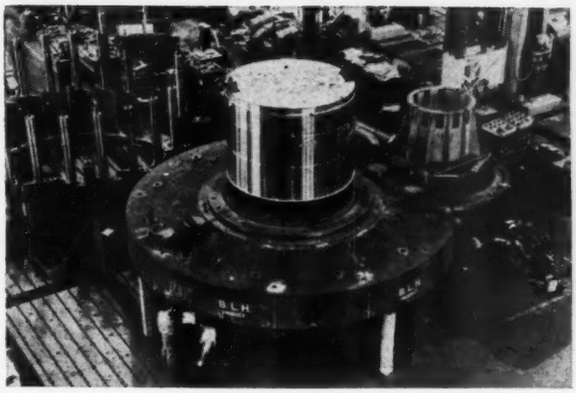


Turning point for the Navy's giant "Big Dish" radio telescope, to be erected at Sugar Grove, W. Va., is this 286-ton main pintle assembly under construction by Baldwin-Lima-Hamilton Corp., at their plant located at Eddystone, Pa.

NERV (Nuclear Emission Recovery Vehicle) launched from Point Arguello, Calif., September 19 by NASA to 1,200-mile altitude was recovered safely by Navy. The Argo D-8 booster was by Ryan Aerolab, radiation-studying capsule by GE.

research center or "facility," for which funds will be requested in the fiscal '62 budget. The facility would concentrate on three major disciplines: (1) flight medicine and biology; (2) space medical and behavioral sciences; and (3) space biology. Some sixty professionals to man these sections are contemplated. By having an actual physical site, NASA hopes to be able to attract qualified scientists for its program.

On the surface, there would seem to be nothing wrong with these proposals, and it is necessary to go deeper than the surface to point up the fact that the space-medical side of the nation's astronautical program is rapidly headed for the hamburgerizing process that has already attended the rocketry hardware side of the program.

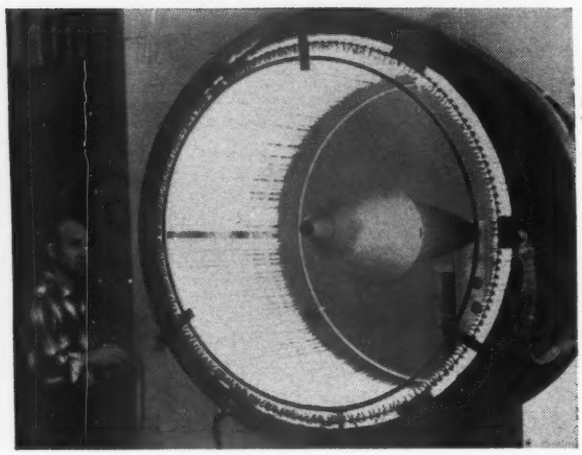
How NASA happened to reach its decision to enter the life-science business is a matter of obscure but disturbing recent history. Last year a blue-ribbon committee of medicos called the Kety Committee after its chairman, Dr. Seymour Kety of the National Institutes of Health, was appointed by NASA to study the question of whether NASA ought to set up its own life-sciences capability. The Kety Committee, which straightforward sources report did not visit a single existing military life-science installation but worked rather from information supplied by briefing teams, finally suggested in January 1960 that NASA ought to have its own facilities.

Part of the rationale of the Kety Committee's view was ironically based on what it interpreted as a lack of surety among the military that the military role in space had been established for certain. From this the Kety group proceeded to an expressed fear that space-medical capability might weaken in the military and that to prevent such a circumstance, it was NASA's bounden duty to set up its own capability. Shortly after submission of the Kety report, NASA announced establishment of its Office of Life Sciences, and in later elaborations described the various liaisons that would—to keep everyone posted and prevent duplication, etc.—link NASA with the military, the Atomic Energy Commission, the Federal Aviation Agency, and the host of other agencies interested in life sciences.

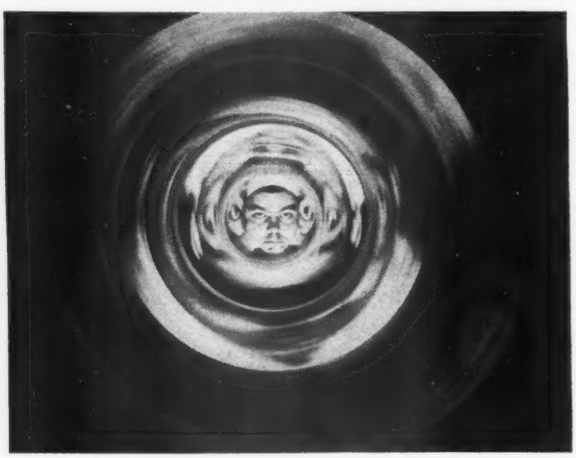
On a chart, it looks neat, but in truth it doesn't make sense. Yet the difficulty in fair criticism of such arrangements is unbounded, because one barely knows where to start.

There are, however, some certainties which militate against additional splintering at the space medical effort. For one, no matter how many charts and grandiose plans are outlined, the fact remains that the number of qualified biological researchers in the United States is quite limited, and that those among them with interest and competence in space medicine are even more limited. Further, the latter group is for the most part already employed by the military or in industry.

An additional facility—no matter who runs it —is only going to get a lot of people moving in the perennial technological employment merry-go-round that has become a distressing obstacle to the orderly development of our space programs. It was not too long ago that the Air Force and the FAA had to resort to diplomatic negotiations to halt friction that developed after a personnel exodus from the Air Force School of Aviation



NASA's Langley Research Center, Va., simulates heat a third as hot as the sun's surface with this cylindrical radiator of General Electric quartz infrared lamps. The device is used to aid the study of "thermal barrier" reentry temperatures.



Space face in triplicate is reflected by metallic whirlpool effect created by the high polish of this new Republic Corp. wind tunnel at Farmingdale, N.Y. Speeds up to Mach 20 (some 15,000 mph) will eventually be generated in the new facility.

Medicine at Brooks AFB, Tex., to the FAA's new flight medicine facility in Oklahoma.

Secondly, notwithstanding the semantics involved in attempting to differentiate between aviation medicine and space medicine, which some of the NASA people have indulged in, it remains a fact that space medicine *is* a direct evolution from aviation medicine and that, in the face of money and moral support shortages in the pre-Sputnik era, the main contributions to what space medical knowledge exists today were made at military laboratories by both military and civilian scientists.

Thirdly, and perhaps most importantly, somewhere, somehow, it must be accepted that committees and liaisons do not accomplish the work at hand—that when you are, for example, designing a habitable space capsule, it is still the fellow in the lab who does the job, and that the best a committee can do most of the time is agree eloquently that a space capsule ought to be designed.

It is a pity that the space-medical program is so fragmented—and will soon be more so. This is by no means the fault of only NASA. Within the Air Force, despite its possession of what is probably the greatest national competence in this area, there is no single organization directing the bioastronautical effort. Instead, it is scattered among two major commands and the Air Staff, while the office of the Surgeon General tries valiantly to keep track of what is going on where. The same picture obtains somewhat in the Navy, also the repository of a lot of skill in this area.

There are two basic problems to be solved in this worsening situation. The first solution requires imagination and the second courage. Imagination would design a strong program to create new reserves of life-science skill through fellowships and grants. NASA, working with other executive agencies, could do brilliant service in this area—better service than devoting itself to the construction of research laboratories it will have a tough time filling.

And courage would mark a decision to recognize the need for space medicine to be regarded as a functional military mission, organized so that existing military capability could serve both NASA and defense requirements in the future.

New names on new doors will not take astronauts safely into space.

Space Capsules

Good reading: *International Political Implications of Activities in Outer Space,* a RAND Corporation Report (Number R-362-RC). Write RAND CORPORATION, Santa Monica, Calif., for information on availability. . . . Soon on the bookstands, *Flying Saucers and the US Air Force,* (D. Van Nostrand, Princeton, N.J.) by USAF MAJ. LAWRENCE J. TACKER, which relates the Air Force side of a controversy wherein retired Marine Corps MAJ. DONALD KEYHOE has accused the Air Force and the Central Intelligence Agency of suppressing information on saucer sightings. Major Keyhoe is a leader of a group which believes that saucer sightings indicate extraterrestrial observation of our planet.—END

THE CREATIVE CAPACITY OF MAN IS EQUAL TO THE CHALLENGE OF SPACE. This is the supreme equation of our time. Scientists and engineers at Martin-Denver are among those who have made significant contributions toward proving it. You may be aware of their advances in the physical and bio-sciences, in space vehicles and systems. If you would like to join them, write: N. M. Pagan, Director of Technical and Scientific Staffing, Martin-Denver, P.O. Box 179B-9, Denver, Colorado.

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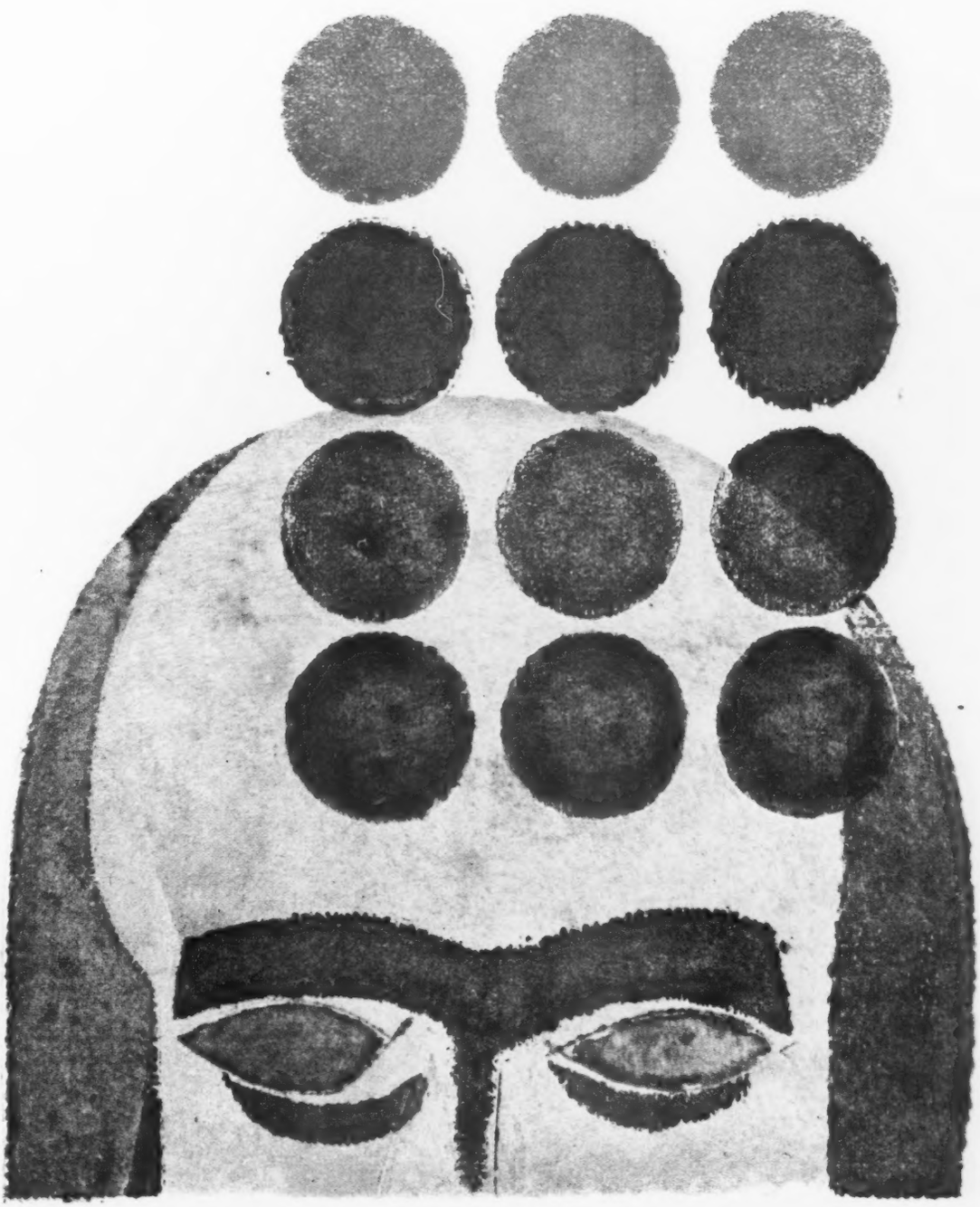

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Flight-line checkout by DATS (Dynamic Accuracy Test System) tells the interceptor commander whether his aircraft and weapon control systems are completely ready for a successful mission. As a result of field evaluation tests, showing the effectiveness of DATS in improving weapon control performance, RCA has been awarded an Air Force production contract. Developed by RCA's Airborne Systems Division, Defense Electronic Products, Camden, New Jersey, DATS is a new approach to the evaluation of system readiness. It makes certain that only aircraft with properly operating weapon control systems are sent on missions. Based on a building-block design employing the highest reliability factors, a mechanical programming device and self-test capability, DATS utilizes a series of synthesized attack runs typical of mission conditions. DATS could be made applicable to many interceptor types of aircraft.

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AIR FORCE
NOVEMBER 1960

An erudite assembly of Air Force mathematicians, physicists, electronics engineers, and technicians is at work on a formidable task in a bombproof basement beneath the Nebraska prairie. Their unique job, which involves no little pioneering, consists of...

BLUEPRINTING BULL'S-EYES for the BALLISTIC BIRDS

TSgt. James R. Doherty, USAF

PHOTOS BY SMSGT. WILLIAM E. LUMMUS

IN COMMON with most old pros in the military intelligence business, Col. Jack Whitson looks about as deadly as your corner grocer. He is slightly built, appearing neither younger nor older than his forty-one years, and his tanned face is pleasantly guileless.

Nevertheless, as chief of the Strategic Air Command's spanking new Trajectory Center, Jack Whitson is custodian of enough Top Secret documents to wallpaper the Pentagon. His formidable assignment: computing the flight path toward preselected targets for every intercontinental ballistic missile in the growing SAC arsenal. The center is an integral part of the Hq. SAC nerve system and is the direct responsibility of Brig. Gen. R. N. Smith, Strategic Air Command Director of Intelligence.

The colonel's office is located a few dozen feet beneath the surface of the Nebraska prairie, in the bombproof basement of the sprawling SAC Headquarters building ten

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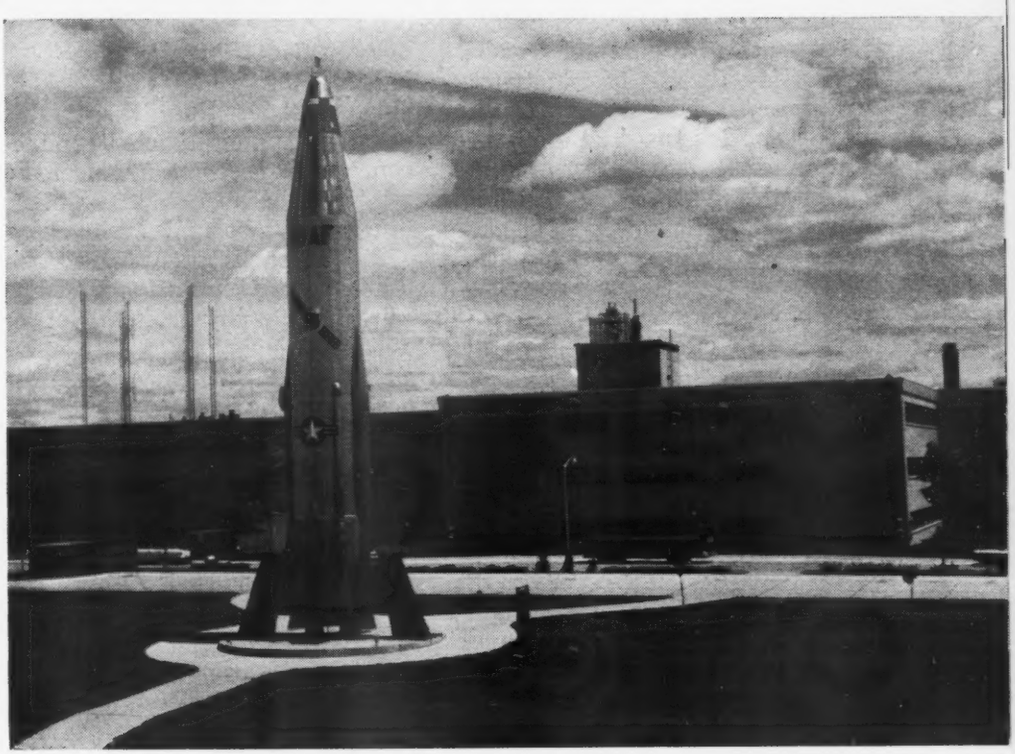
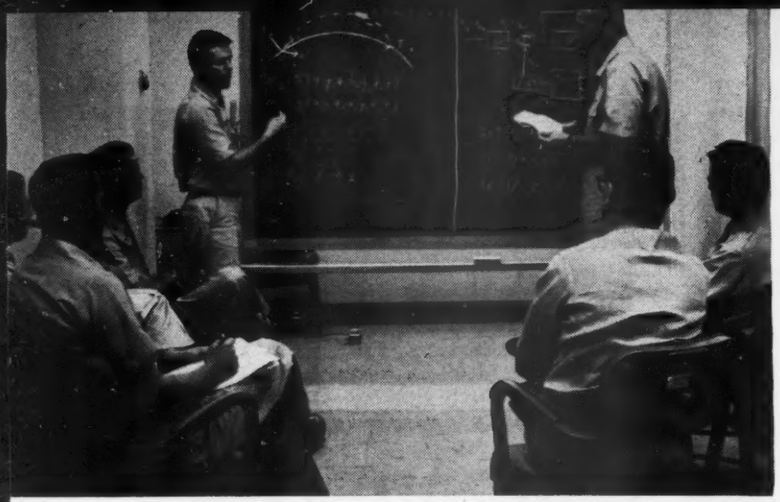
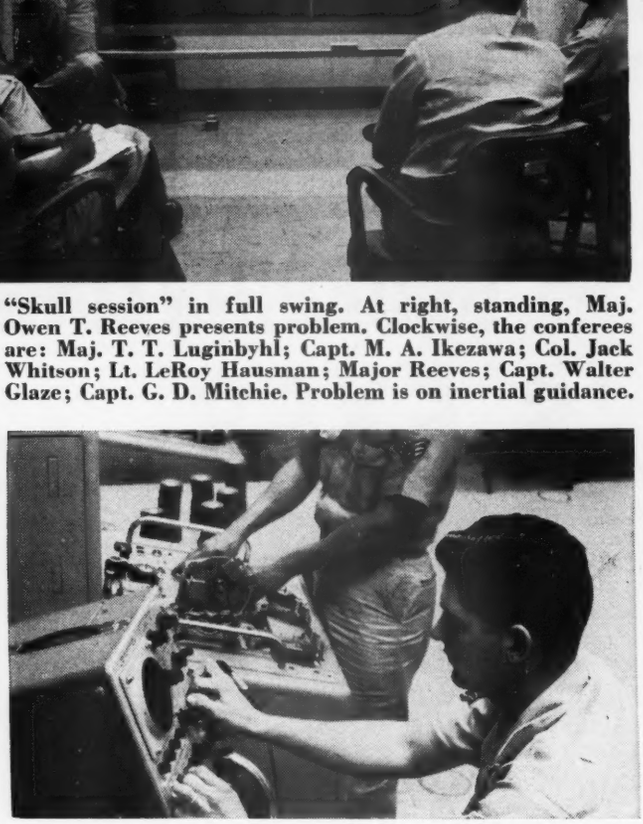


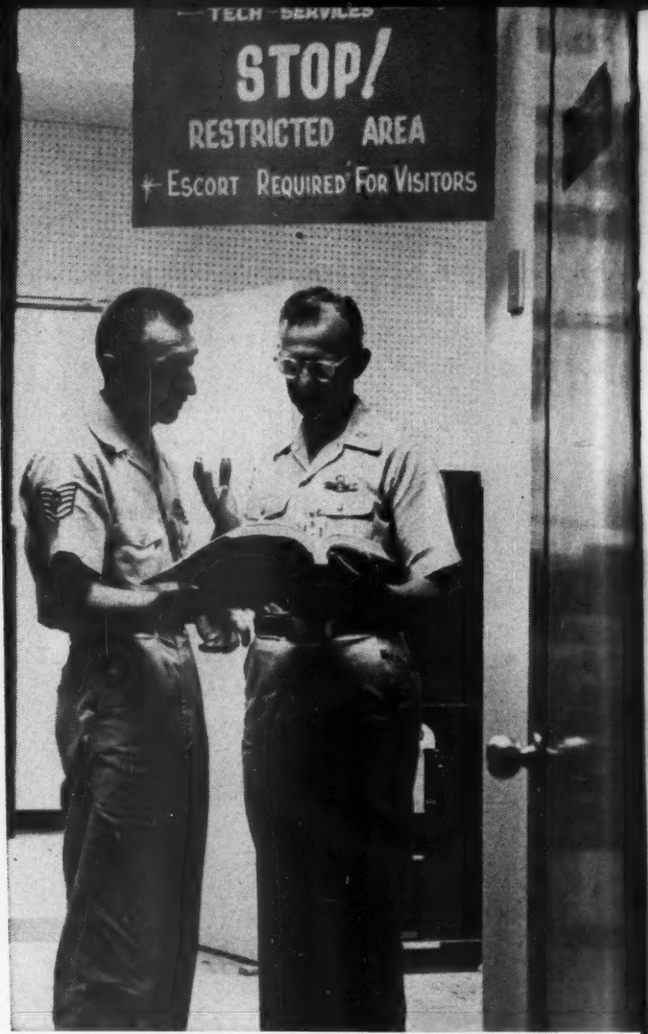
Strategic Air Command's Trajectory Center is located in the basement of this large, modern, three-story headquarters building that is a landmark on the Nebraska prairie, some ten miles south of Omaha. Symbolic of SAC's aerospace age capabilities, the Atlas missile near the entrance is a former test vehicle.



"Skull session" in full swing. At right, standing, Maj. Owen T. Reeves presents problem. Clockwise, the conferees are: Maj. T. T. Luginbyhl; Capt. M. A. Ikezawa; Col. Jack Whitson; Lt. LeRoy Hausman; Major Reeves; Capt. Walter Glaze; Capt. G. D. Mitchie. Problem is on inertial guidance.



Among the complicated technical responsibilities at the T-Center's Technical Services Branch is the manufacture of punched tapes that will be inserted into guidance mechanisms of the Snark intercontinental cruise missile. Here enlisted specialist personnel get on with that job.



Security is a byword at SAC, especially in the sensitive and important T-Center, where the sign with the clear lettering means what it says. The Center's Technical Services Branch is headed by Maj. Joseph H. Gallagher, right, conferring here with NCO in charge, TSgt. John L. Brahosky.

miles south of the city of Omaha.

His staff consists of twenty-five officers and a like number of enlisted men. It is an erudite assembly. Among its members are mathematicians, physicists, electronic engineers, and a sprinkling of garden-variety technicians. Corralled from throughout the Air Force, they do a unique pioneering job.

Colonel Whitson, a graduate of the US Military Academy, is an expert at reducing the T-Center's problems to their space-age fundamentals.

"Granted, our operational missiles are masterpieces of design," he explains. "But let's face it, they can't think for themselves. You can't hand a map or a set of coordinates to the guidance system of an Atlas and expect the bird to direct itself to a given target. Our job is to convert a fistful of material to instructions the guidance mechanism can understand."

Luckily for all hands in the T-Center, SAC's Command Post boasts a giant IBM computer, which lightens the work load considerably. Without the indispensable electronic brain, a missile might conceivably become obsolete by the time one man could solve the trajectory problem.

Take the case of Atlas. To aim this first of SAC's operational ICBMs correctly, literally thousands of individual calculations must be made and checked—then rechecked. Most deal with the bird's aerodynamic characteristics—its weight, size, shape, and how it's expected to fly.

The bulk of the technical book on any missile is prepared by the manufacturer's engineers. Their contribution, however, leaves the final trajectory equation far short of a solution.

Still to be considered are the effects of gravity, winds upon reentry, atmospheric density, and such things as the elevation of the launch site, size and shape of the terrestrial ellipsoid—the list goes on and on.

Not the least among a missile aimer's headaches is the size and shape of the reentry vehicle itself. Equations in this regard must be altered with each succeeding modification in the nose-cone package.

If this sounds like heady stuff—it is. One may quite naturally ask where SAC found uniformed personnel with the required mental horsepower.

The answer can be found in Air Force archives. For years the service has maintained an extensive training program in the basic sciences. Many officers currently helping to pry open the doors to space received their scientific baptism at the old Air Corps Engineering School at McCook Field, Dayton.

Later, when the Air Force Institute of Technology took over, a sizable reservoir of engineering know-how began to accumulate.

In 1957, after the feasibility of a nuclear warhead for guided missiles had been firmly established, SAC issued an Air Force-wide call

for engineers and mathematicians.

Selected volunteers reported to the Air Research and Development Command's Ballistic Missile Division, Inglewood, Calif., for a period of training that lasted approximately one year.

Among the first to receive his orders was Maj. Owen T. Reeves, who today functions as Colonel Whitson's strong right arm in the busy T-Center. Major Reeves, a graduate of West Point with a master's degree in electrical engineering from the University of Illinois, is chief of the Center's Plans and Organization Branch.

When the summons went out for T-Center volunteers, Major Reeves was flying a B-47 Stratojet for the 97th Bomb Wing, Biggs AFB, Tex.

During a one-year stint at AFBMD, he specialized in missile guidance systems. Nowadays, he will wax lyrical on the subject at the drop of a punchcard—but with reservations.

"As sophisticated as our guidance systems are," he points out, "a great deal of precomputation is still necessary.

"Of course, we *could* build an airborne computer big enough to do the calculating in flight. But the amount of power that would be necessary to get such a gadget off the ground makes the idea impractical. We do the next best thing. We substitute days and weeks of hard work, in the form of precomputations, for on-board capacity."

As an annex to the underground Command Post, the T-Center would be a tightly guarded, busy area in the event of a nuclear attack against the US. Of course, the missile aimers would already have completed the lion's share of their work long before the balloon went up.

"Even with high-speed digital computers, we wouldn't have enough time to do the job if we waited until we were hit," Major Reeves explains.

From his subterranean cubbyhole outside Colonel Whitson's office, he oversees the continuing preparation of target folders for every missile in the inventory. It is a tedious, time-consuming process.

First, the "deck" of aerodynamic information supplied by the manufacturer is combined with the package of geodetic information provided from the technical files of the Geo-Sciences Branch. This latter department is responsible for reducing geodetic, astronomic, and geophysical survey data on both launch sites and targets to a form usable for trajectory computations.

The "geodetic bit," say the mathematicians, is not quite the simple piece of business the layman might imagine. Science to the contrary, it is still no cinch to pinpoint a single spot on the face of this uneven globe with precise reference to another. But a world geodetic system has been designed that does minimize discrepancies in relative positions of launch site and target.

Among other factors involved in this phase of precomputation are the exact heights above sea level of both target and launch points, gravity value, certain astronomic parameters, and highly technical quantities dealing with the nature of the earth. This data is obtained from intelligence sources available to SAC, and checked and double-checked in the T-Center.

The T-Center must be certain of the selection of proper data, geodetic systems, and spheroidal constants that most accurately describe

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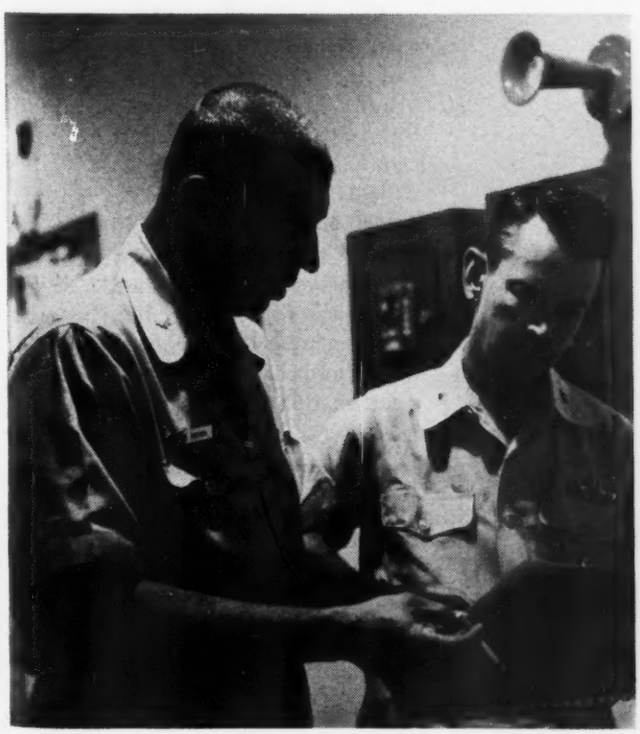
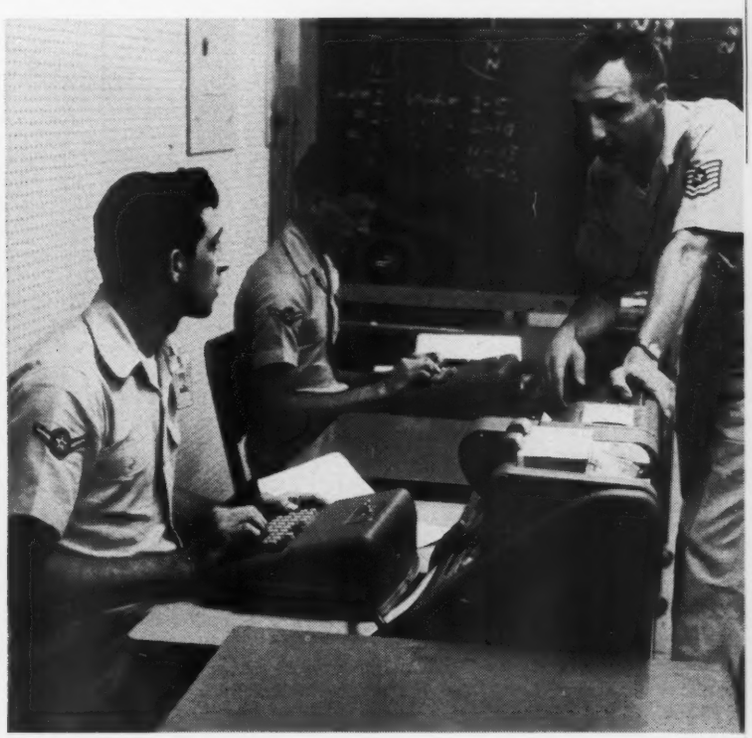


Major Reeves and Colonel Whitson hold a quiet conference in a corridor underneath the sprawling SAC Headquarters building and examine Trajectory Data sheets, which when completed will be dispatched to one of SAC's several missile launching bases, distributed over the United States.



Technical Services' Sergeant Brahosky spells out details of a Trajectory Creation sheet to IBM machine operator. The trio of specialists is busy "translating" pages of trajectory mathematical calculations into "machine language" that SAC's giant computer device can handle.

This plastic model of the earth, being consulted here by Geo-Sciences Chief, Capt. Oliver G. Caldwell, right, and TSgt. Donald P. Russell, aids in preparation of accurate trajectory data.

the size and shape of the earth, as well as locations of launch site and target. It is for this reason that the T-Center has been assigned a position within SAC Intelligence. Specifically, it is a subdivision of the 544th Reconnaissance Technical Group.

When the manufacturer's deck and that of the Geo-Sciences Branch have been "shuffled and dealt," T-Center mathematicians put in the variables. These include weight changes in the missile as it consumes fuel in flight, power variables, engine operation, and a host of other critical "X" factors.

The result is a "Creation Sheet" for a trajectory—a blueprint for a bull's-eye.

At this point, however, the problem is not yet whipped. Rarely do the center's experts come up with a completely acceptable answer the first time. Again, Major Reeves is ready with an explanation.

"The earth's mass prohibits precise formulas. Because mass varies all over the globe, the force of gravity is never constant. So our initial findings as to a particular shot represent what might be termed 'educated guesses.'

"Just now, we're in the business of refining these guesses by a process known as numerical analysis. It amounts to this. The more potshots we take with the computer, the nearer we come to a perfect aiming formula."

For all practical purposes, the T-Center's work will never be done. Target priorities do not remain fixed. Today a missile may be programed for a certain industrial complex. Tomorrow, a different target may be substituted, or other targets may be added, as SAC strategists see fit.

The target folder for a particular missile contains the all-important settings that launch-site technicians will make in both ground guidance mechanisms and in the guidance system of the bird itself. When this has been accomplished, the missile is placed on alert. Only then does it become a "plus factor" in the SAC war plan.

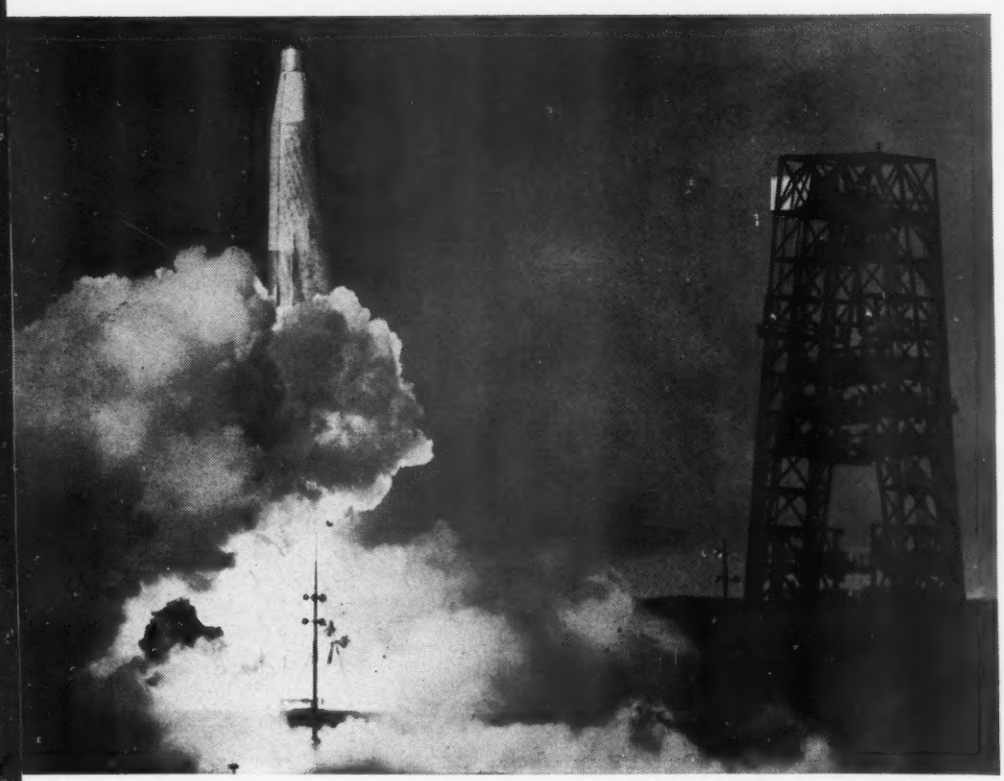
Eventually, the T-Center will be cranking out target kits for the Titan and Minuteman ICBMs, in addition to Atlas. Currently, it is generating route information for intermediate-range missiles at emplacements abroad.

For the Snark, an intercontinental cruise missile, Colonel Whitson's men compute the guidance.

In the months to come, as one new missile site after another becomes operational, the tempo of life in the T-Center will noticeably increase. But the stepped-up chatter of the computer will signal no panic here, either now or in the future.

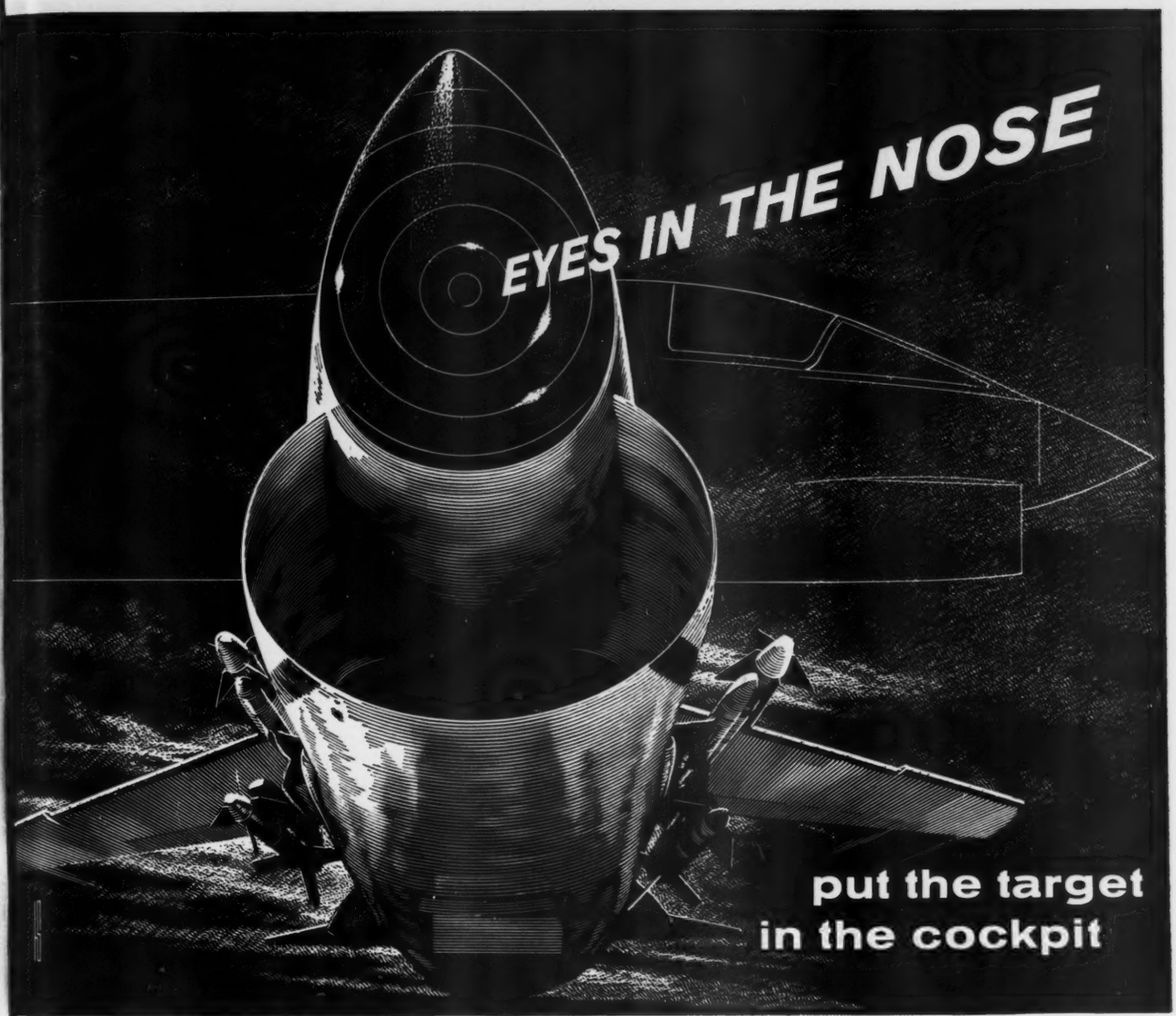
In the dozen well lighted offices that surround his own, Colonel Whitson has assembled the cream of SAC's uniformed mathematicians and engineers. They're staying abreast of their peculiar problems and thinking ahead.

SAC's ballistic missiles and the desk-bound sharpshooters who "aim" them have yet to be tested in battle. The command's T-men hope they never will be. But if the need arises, they trust their efforts will help drop the big birds on target on the other side of the globe.
—END



The blastoff is the payoff for all the complex work. In the event of nuclear attack on this country and consequent retaliatory action, the fiery, truly aimed launch of missiles such as this Atlas ICBM, shown as it rose in a test from Vandenberg AFB, Calif., will be the culmination of work done at the vital T-Center.

The author, Jim Doherty, is a tech sergeant information specialist at SAC Headquarters, Offutt AFB, Neb. He is a veteran of fifteen years of military service, twelve of them in the Air Force and three in the Coast Guard. During World War II, he flew thirty-five missions as radio operator-waist gunner with the Fifteenth Air Force in Italy. Sergeant Doherty's byline appeared in AIR FORCE *last month with his article on the Minuteman Test Train.*



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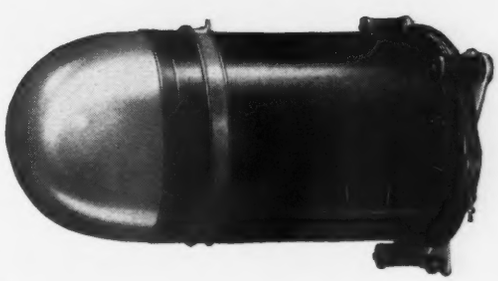

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COMMUNICATIONS	RADAR	DATA HANDLING	ASW	MISSILES

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the Ready Room

RESERVE AND AIR GUARD NEWS

San Francisco Spotlight

The **reserve forces played a prime role** at the 1960 Air Force Association Convention in San Francisco.

Reserve forces highlights at the Convention were:

- **The Ricks Trophy event,** a two-day, seven-phase aerial competition combining a weapons meet and a speed run to demonstrate the Air Guard's combat readiness.
- **The Reserve Forces Seminar,** biggest and perhaps most significant in AFA's history to date.
- **Awards to the reserve forces' outstanding units and airmen,** and other individuals who made vital contributions to reserve forces programs during the year.

In addition, Convention delegates passed a number of **important resolutions** on the reserve forces and their missions.

The **Reserve Seminar** was the main event for reserve forces members, producing a **packed house of some 600** and a speakers' platform loaded with stars. On hand were the heads of the **major USAF gaining commands**—the commands into which reservists have in effect been operationally integrated in the new reserve organization. **Gen. Frank F. Everest** was there for the Tactical Air Command; **Lt. Gens. Joseph H. Atkinson** for the Air Defense Command, **Joe W. Kelly** for the Military Air Transport Service, and **William E. Hall** for the Continental Air Command.

On one side of the speakers' rostrum sat the reserve forces' top leaders—**Maj. Gens. Robert E. L. Eaton,** Assistant Chief of Staff for Reserve Forces; and **Winston P. Wilson** of the Air National Guard, and **Brig. Gen. Felix L. Vidal** representing the Air Force Reserve (*see cut*).

Opposite them were **Maj. Gen. Clarence A. Shoop,** California ANG chief of staff and chairman of USAF's Air Reserve Forces Policy Committee, who moderated the seminar; ANG **Brig. Gen. Howard T. Markey,** outgoing President of AFA and an Illinois ANG wing commander, who introduced the speakers; and **Brig. Gen. Roy T. Sessums** of Louisiana, AFA's Reserve Council chairman; and his Air Guard Council counterpart, **Col. Bob Campbell** of California who handled the presentation of awards.

General Everest described how the Air Guard's **tactical fighters and reconnaissance units** and the Reserve's **troop carrier squadrons** fit into his command structure.

"My command depends unquestionably more than any other on the reserve forces for its mobilization strength," he declared. The **outstanding performance of Reserve and Guard forces in Pine Cone III,** he said, convincingly demonstrated their capabilities not only to TAC's major customer, the ground forces, but also to the active members of TAC's family.

General Everest said he felt that reserve wings are presently well equipped. A **cycle of equipment changes** will be undertaken progressively, he stated, with substitution of C-124s for some C-119s and C-123s.

Noting that there are **no insurmountable problems** in line with equipping the medium troop carrying force, he went on to say that in the **area of tactical fighters** the Air Force **faces a more difficult problem.** He remained hopeful, he declared, that more suitable aircraft will eventually be assigned to his command's Air National Guard units.

Some reserve forces crews will take part in **overwater deployment exercises** beginning this fiscal year, General Everest further reported. By next year, he said, TAC **expects to spring "no-notice"** deployments on some reserve forces units.

In conclusion, General Everest told the Reserve Forces Seminar that **TAC does not expect further staff realignment or functional changes** with respect to supervision of training and inspection of air reserve forces units. Stressing that there is **no "second team" in the Tactical Air Command,** General Everest said, "The regular units, the Air National Guard, and the reserve units form jointly **one major division of our Air Force.** If we are going to fight as one team if war comes, we **must be one team** in peace."

General Atkinson declared that ADC "must lean heavily on **effective utilization of our Air National Guard fighter-**

(Continued on following page)

A panel of the reserve forces' top leaders sit on speakers' rostrum at Reserve Forces Seminar event of AFA Convention in San Francisco. They are, left to right, Brig. Gen. Felix L. Vidal representing the Air Force Reserve, Maj. Gen. Winston P. Wilson of the Air National Guard, and Maj. Gen. Robert Eaton, USAF Assistant Chief of Staff.

interceptor and AC&W squadrons. We must spare no efforts in assuring that these units are effectively equipped, trained, and integrated into the over-all air defense effort."

He said a large number of individual reservists are fulfilling essential M-day assignments with ADC. "The record of these dedicated individual reservists in ADC has been excellent," he said. "I have directed the ADC staff to **improve training programs** and to take all other practicable measures to **further exploit this excellent air defense potential.**"

General Atkinson noted that ADC has recently been authorized **eight reserve general officer positions**—one as mobilization assistant to the ADC commander and seven as mobilization assistants to ADC division commanders. They will assist commanders, he said, "**in reserve affairs, military-civil liaison, public relations, and other important areas** where their acquaintance with civilian officials and understanding of the area situation will give them added background to operate effectively for the Air Force."

In response to a question from the floor, General Atkinson acknowledged that the **development of missiles will reduce the number of manned interceptors** required in air defense.

But, he added, "**I can't foresee the time when interceptor aircraft won't be required.**"

Outstanding Air National Guardsman and Air Reservist, who took part as honored guests in Convention. Left, ANG's SSgt. Clarence E. Cunningham, 130th Troop Carrier Squadron, Charleston, W. Va. Right, Reserve's MSgt. Francis E. Nowicki, 512th Troop Carrier Wing, Willow Grove, Pa. Mrs. Cunningham accepted award for husband at Convention.

General Kelly, who recently assumed command of MATS, summarized the growing Joint Chiefs of Staff **requirement for emergency airlift,** and suggested three ways to meet that requirement.

One, he said, is to **expand MATS,** but that could be done only at considerable expense and the risk of public criticism. The alternatives, he said, are to **depend on the Civil Reserve Air Fleet** (CRAF) or on the **air reserve forces.**

While MATS expects to use CRAF in event of a war or emergency, he said, this alone would not be enough.

"**This leaves the reserve forces,**" General Kelly continued. "Trained by MATS and ready, wearing the same uniform, motivated and disciplined, the reserve forces offer our nation's best hope of increasing wartime strategic airlift augmentation of MATS."

He reported that MATS today is authorized a total of **165 reserve forces units**—sixty-two in the **Air Force Reserve** and 103 in the **Air Guard.** Some 19,000 people are authorized in these units. In addition, MATS has **16,000** individual mobilization assignee slots.

Flying units assigned to MATS include, he said, "**six airlift squadrons** with nine more to come, **five air evac squadrons** with four more to be added, and **five air rescue squadrons.** In all these units morale is high and capability is good. . . .

"I assure you that reserve forces strategic airlift squadrons can look forward to some realistic training with MATS," General Kelly said, "in exercises that will take them literally to **almost any part of the world.**"

Rounding out the seminar session, **General Hall** gave a comprehensive report on **missions of the new base support and recovery groups** now being organized under CONAC.

As reported in "Ready Room" last month, CONAC plans **fifty or more base support groups** and **eighty-two recovery groups,** with each of the latter containing one or more units.

General Hall emphasized that these recovery and base support groups will **comprise the entire nonflying program of the Air Force Reserve,** except for a few thousand Part I mobilization assignees. Recovery units will be administered by reservists, with no active duty personnel.

"The basic difference between these two types of units is very simple," he said. "The assumption is that in a major conflict many Air Force bases will be damaged to such an extent that aircraft will be unable to land at their home bases or preplanned alternates.

"Reserve base support units will augment the active base units in **returning damaged bases to usable condition in the quickest possible time.** Reserve recovery units, on the other hand, are charged with planning for the use of predesignated airfields other than active military installations."

Resolutions on the Reserves

In an important Convention resolution, AFA delegates called for a **buildup of strategic airlift capability for MATS and augmenting airlift units of the Air Force Reserve and Air National Guard.** Congress should enact "appropriate legislation" on this score, AFA declared.

Resolutions pertaining to the reserve forces also:

- Recommended **continuing utilization of the air reserve forces** through more realistic integration in the ever-changing mission of the active establishment, including possible overseas deployment and around-the-clock continental air defense.
- Cited the need for **continuing modernization of all airlift and weapon systems assigned to the air reserve forces.**
- Requested that **reserve airmen be paid at the same rate for quarters allowances as regular airmen** when a reservist is called to active duty.
- Endorsed Air Force and Department of Defense action toward **fuller utilization of the air reserve forces** and toward increased airlift responsibilities for the reserves.

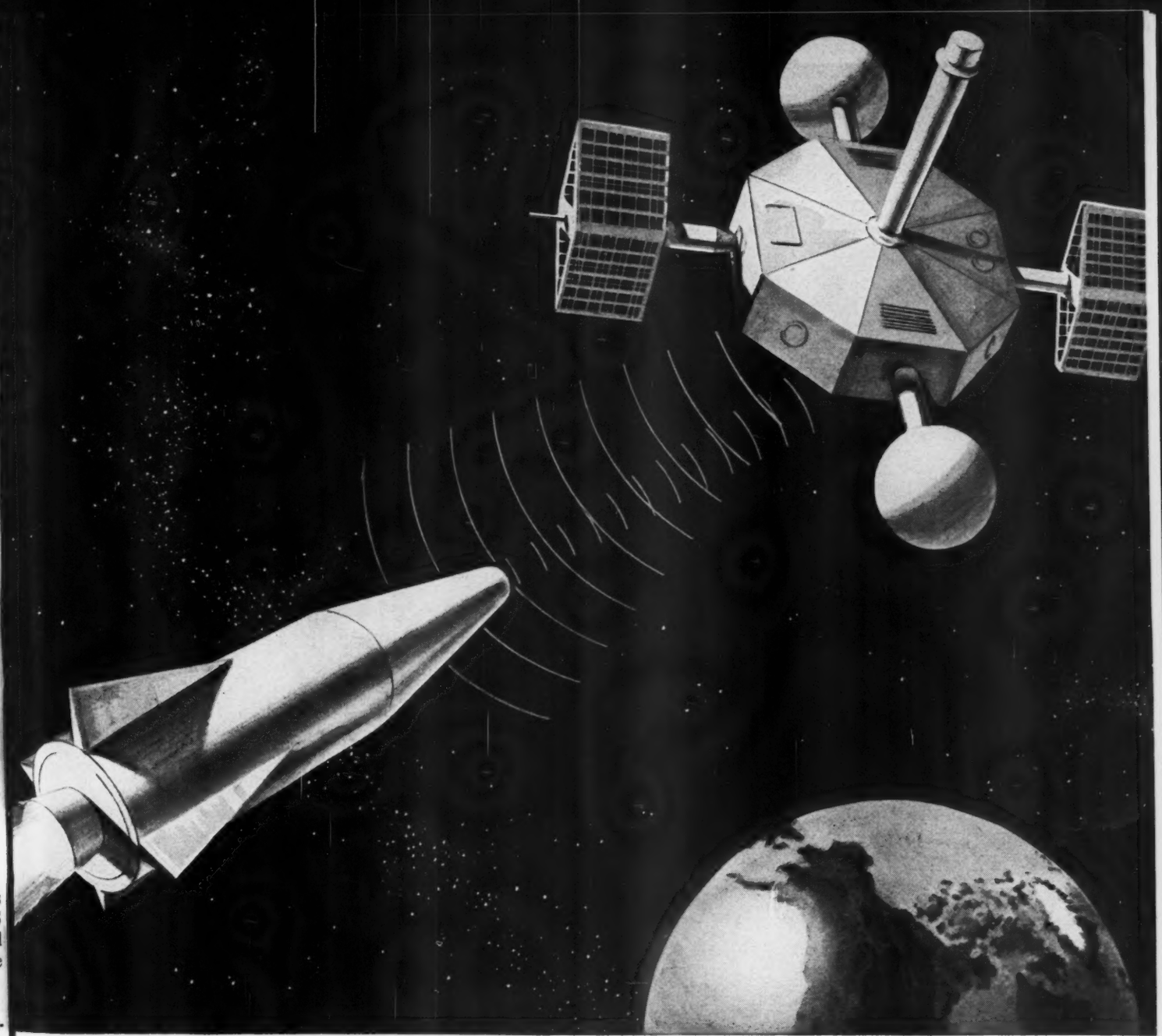
Reserve Forces Awards

A petite, attractive young mother from Big Chimney, W. Va., easily stole the show during awards presentations at the **Reserve Forces Seminar.**

She was **Mary Jane Cunningham,** whose husband had been named the **Air National Guard's outstanding airman.** SSgt. Clarence S. Cunningham, however, suffered a collapsed lung shortly after their arrival in San Francisco and spent the Convention in the Hamilton AFB hospital.

When Mrs. Cunningham rose to accept her husband's

(*Continued on page 119*)



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ANG Maj. Milan R. Forkapa, Jr., winner of Ricks Memorial Trophy aerial competition that opened Convention. Ohio Guardsman receives trophy from ANG chief General Wilson at Hamilton AFB, Calif., where Ricks flights terminated.

award from **Col. Bob Campbell,** chairman of AFA's Air Guard Council, the audience gave her a standing ovation.

Sergeant Cunningham, a flight engineer in the Air Guard's **130th Troop Carrier Squadron** of Charleston, W. Va., is convalescing at home.

AFA's award for the Air Force Reserve's outstanding airman went to **MSgt. Francis E. Nowicki** of Wayne, Pa., first sergeant of headquarters squadron in the **512th Troop Carrier Wing,** Willow Grove, Pa. Sergeant Nowicki, active in civic affairs and an excellent speaker, received the award from **Brig. Gen. Roy T. Sessums,** chairman of AFA's Reserve Council.

The 445th Troop Carrier Wing, Dobbins AFB, Ga., represented by its commander, **Col. George H. Wilson,** won the AFA trophy for the outstanding reserve flying unit. Two Air Guard squadrons shared the AFA trophy, having tied for outstanding unit honors. They are the **141st Tactical Fighter Squadron** of McGuire AFB, N. J., represented by its commander, **Col. John C. Makely,** and the **163d Tactical Fighter Squadron,** Fort Wayne, Ind., led by **Maj. Eugene D. Royer.**

Outgoing AFA President Markey presented special citations to three Air Guardsmen, members of the Air Guard Council, who **prepared AFA's report on the reserve forces' military airlift capability** for a congressional subcommittee last spring. They are **Col. Roy Cooper,** Cheyenne, Wyo.; **Lt. Col. Robert (Phil) Knight,** Minneapolis, Minn.; and **Lt. Dale Hendry,** Boise, Idaho.

General Wilson presented the **Winston P. Wilson Trophy,** named in his honor, to the Air Guard's top interceptor unit at the Night Fighters' Luncheon. The unit was the **133d Fighter Group** of Minneapolis-St. Paul, Minn., represented by its commander, **Col. Ralph M. Jerome.**

Generals Hall and Wilson both received **AFA Citations of Honor** during the Convention. The plaques, awarded at the Aerospace Luncheon, honored these two officers for their **outstanding contributions to national security** in building the units of the air reserve forces to the **highest state of readiness** in air reserve forces history.

Tactically Tops

The **top tactical fighter pilot** in the Air National Guard is **Maj. Milan R. Forkapa, Jr.,** commander of the **112th Tactical Fighter Squadron** of Toledo, Ohio.

Major Forkapa, a thirty-six-year-old veteran of Sicily-Italy air combat in World War II, earned this distinction by beating eleven other pilots picked by their squadrons to complete in the **1960 Ricks Trophy event.**

All twelve pilots flew the **Republic F-84F Thunderjet.**

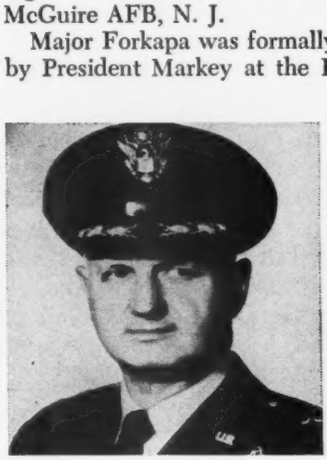
The 1960 Ricks Trophy event was a two-day, seven-part competition, opening with a **weapons meet on the range at George AFB, Calif.,** on September 20 and ending with a **speed run from George to Hamilton AFB, Calif.**

Forkapa placed first in **only one of the seven categories,** but his total score of 658 out of a possible 1,000 was well ahead of his nearest competitor.

Top score in the speed run went to **Lt. Col. Paul E. Hoover,** commander of the 166th Tactical Fighter Squadron, Lockbourne AFB, Ohio. The 350 points he picked up vaulted him into second place over-all, with a total of 532.

In third place was **Maj. Richard F. Petercheff.** commander, 113th Tactical Fighter Squadron, Terre Haute, Ind., and fourth place went to **Maj. Charles R. Davall,** a flight commander in the 141st Tactical Fighter Squadron, McGuire AFB, N. J.

Major Forkapa was formally awarded the Ricks Trophy by President Markey at the Reserve Forces Seminar.



Maj. Gen. Chester E. McCarty leaves the Third CONAC region, Warner-Robins AFB, Ga., to become Deputy for Reserve Affairs under the Assistant Chief of Staff for Reserve Forces, Hq. USAF.

Pentagon Switch

Maj. Gen. Chester E. McCarty, who has directed numerous airlift operations, will leave the **Third CONAC region, Robins AFB, Ga.,** in the next few weeks to become **Deputy for Air Force Reserve under the Assistant Chief of Staff for Reserve Forces** at Hq. USAF.

He succeeds **Brig. Gen. Felix L. Vidal,** who now commands the **Second CONAC region** at Andrews AFB, Md.

Meanwhile reserve deputy commanders have been named for five of the six CONAC regions. Deputy for the Second region is **Brig. Gen. Ramsay D. Potts;** Third, **Col. Asa Candler;** Fourth, **Col. Roger Zeller;** Fifth, **Col. John W. Richardson,** and Sixth, **Brig. Gen. Luther W. Sweetser, Jr.**—END

Air Force Secretary Dudley Sharp, retired Maj. Gen. Benjamin D. Foulois with USAF's outstanding airmen, guests of AFA at Convention. Four airmen were not present.

General White, seated, and USAFE's outstanding airman MSgt. William Ferreira, at microphone during luncheon in honor of the airmen. Ferreira recalled amusing anecdotes

At the conclusion of the program, which included the presentation of a number of major awards in addition to General White's, the Army Association-Navy League-AFA joint statement was read by Navy League President Frank Gard Jameson. The Army Association's Robert Cocklin stood by at the podium.

Then President Markey announced the second World Congress of Flight, a fitting announcement at the close of the evening's program.

AFA's top annual awards were presented at the banquet, at the Aerospace Luncheon at which General White spoke, and at other events through the Convention.

In addition to the Aviation's Man of the Year award to General White, other annual Airpower Awards went to the late scientist Louis Ridenour, Jr., and educator Wayne O. Reed.

Dr. Ridenour, wartime radar pioneer and outstanding electronic physicist, was awarded AFA's Science Trophy in recognition of his achievements as a "prime architect of the space age" who "left a permanent stamp" on the electronics-space era. Dr. Ridenour was a vice president of Lockheed at the time of his death last year. The award was accepted by his widow.

Dr. Reed, United States Deputy Commissioner of Education, was presented the Hoyt S. Vandenberg Memorial Trophy for "outstanding contributions to the cause of education for the space age."

AFA President's Trophies, also presented at the Awards Banquet, went to O. Donald Olson of Colorado Springs, Colo., as AFA's Man of the Year, and to the San Diego Squadron as the Unit of the Year.

Unit Exceptional Service Plaques went to the Squadrons of the Utah Wing; Anchorage, Alaska, Squadron; Chico, Calif., Squadron; and Erie, Pa., Squadron.

(Air Force Association Awards at the Convention are listed in full in a table on page 42.)

The Air Force's twenty outstanding airmen, named by their commands throughout the world as well as by the Reserve and the Air National Guard, were:

CMSgt. James A. Potter, Air Defense Command.

MSgt. Albert W. Landis, Air Materiel Command.

SMSgt. William J. Bosley, Air Research and Development Command.

CMSgt. Robert E. Holbert, Air Training Command.

SMSgt. Daniel Hackmeier, Air University.

MSgt. Donald E. Kerr, USAF Accounting and Finance Center.

TSgt. James I. Clogston, Alaskan Air Command.

MSgt. Otto H. Lensch, III, Caribbean Air Command.

MSgt. Melvin E. Smith, Continental Air Command.

SMSgt. Robert R. Thompson, Headquarters Command.

SMSgt. Herschell E. McKelvey, Military Air Transport Service.

SMSgt. David E. Hubler, Pacific Air Forces.

CMSgt. Irwin L. Wagner, Strategic Air Command.

SMSgt. Kenneth M. Hawks, Tactical Air Command.

SMSgt. Gordon S. Olson, USAF Academy.

MSgt. William Ferreira, United States Air Forces in Europe.

MSgt. Rex M. Thompson, USAF Security Service.

MSgt. Francis E. Nowicki, Air Force Reserve.

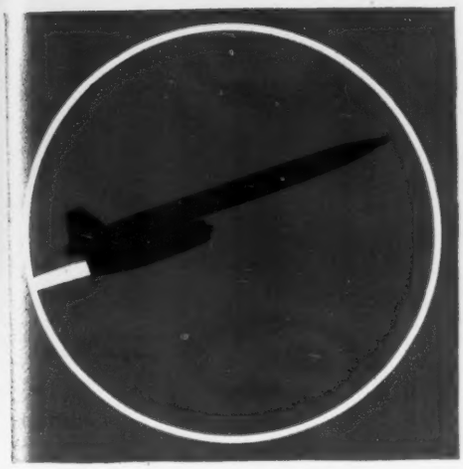
SSgt. Clarence E. Cunningham, Air National Guard.

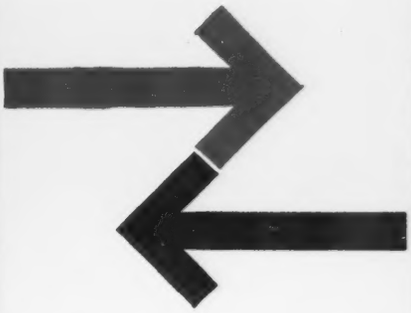
MSgt. Lee Rogers, Recruiter of the Year.

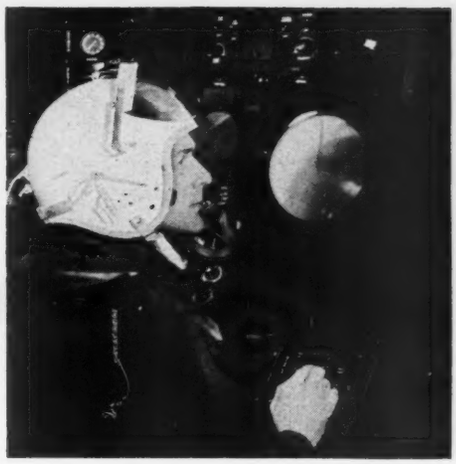
(Continued on page 123)

General White presents Hughes Achievement Trophy, annual award to USAF's leading air defense outfit, to Lt. Col. William Reynolds, Commander, 460th FI Sq., Portland, Ore.

The elements of guidance and control:







Data Acquisition and Application Subsystems—IBM has proven capabilities to provide real-time man-to-machine and machine-to-machine elements of weapon guidance systems. In addition to the Bombing-Navigation system with its visual displays in the B-52, IBM also provides interface devices to apply this system to air-launched missile guidance. Federal Systems Division experience in air-based and ground-based guidance systems is proven in operation.

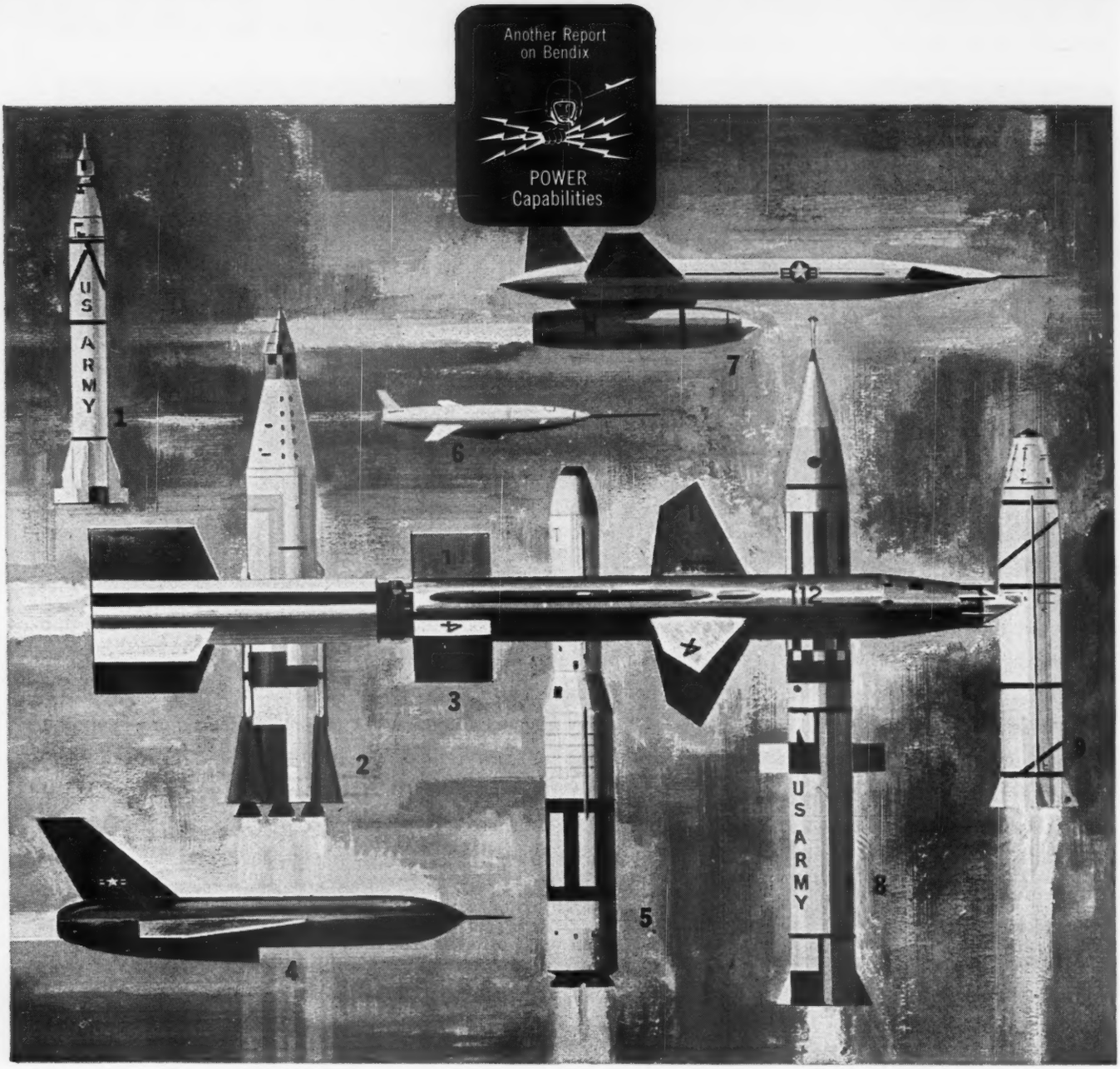
Data Communications Subsystems—The SAGE data processing system, heart of America's air defense network, embodies advanced communications devices and techniques required to filter and direct an enormous flow of data. Designed and built by the Federal Systems Division, the AN/FSQ-7, an advanced system in operation, embodies processing and communications power to direct defense operations as well as to guide missiles from remote sites.

Data Processing and Control Subsystems—Now in development, the Advanced Bombing-Navigation and Missile Guidance system is another example of IBM's "closed-loop" system capability. This system satisfies the operating requirements of high-speed, long-range weapon systems. Compact, reliable equipment such as this and Federal Systems Division's computer for the Titan missile guidance system are the result of IBM's vast background in data processing and control.

all systems capabilities of IBM

IBM's experience in data processing and data communications, supplemented by an extensive background in data acquisition, adds up to a three-way capability for developing, producing and integrating total automated systems. This capability is being advanced through continuing research in miniature high-speed devices for high-reliability guidance systems of the future.

Federal Systems Division, 326 East Montgomery Avenue, Rockville, Maryland **IBM**



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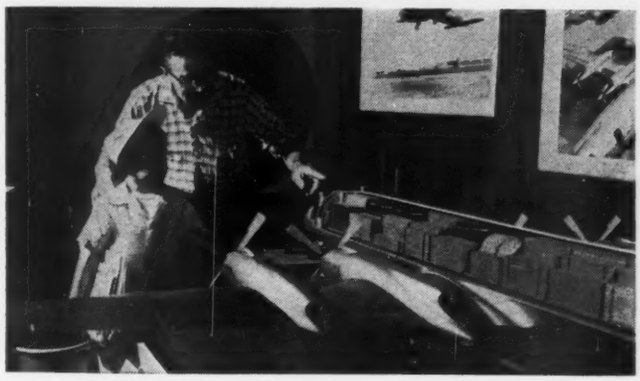
Seven-year-old visitor to Aerospace Panorama points out B-52 model to his father and friend. More than 61,000 San Franciscans came to exhibit when it was opened to the public on the final day of the Convention.



Father and son view cutaway model of turboprop transport at Panorama. In all, there were 197 exhibitors at the 1960 aerospace hardware display. Major Air Force commands displayed representative materials outlining missions.

The Air Force's top air defense squadron was also honored at the Convention. It was the 460th Fighter-Interceptor Squadron of Portland, Ore. The unit, which flies Convair F-102 Delta Dagger aircraft, received the annually presented Hughes Achievement Trophy at a luncheon sponsored by the Night Fighter Association.

To serve with Mr. Stack, AFA's new President, Convention delegates selected outgoing President Markey as Chairman of the Board to succeed Julian B. Rosenthal of New York. The incumbents were reelected to the other two primary national offices. Investment specialist Jack B. Gross of Harrisburg, Pa., remained as Treasurer. George Hardy of College Park, Md., a food brokerage executive, continues as Secretary.

Also named were the eighteen National Directors and eleven Regional Vice Presidents listed in the accompanying box.

(Continued on following page)

A youthful booster for the Air Force. Youngster stands in after end of Thor IRBM rocket engine. A trip through the Panorama provided broad education in defense today, part of USAF-industry-AFA programs to inform the public.

AIR FORCE ASSOCIATION'S NEW LEADERS

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College Park, Md.

PRESIDENT

Thos. F. Stack
San Francisco, Calif.

TREASURER

***Jack B. Gross**
Harrisburg, Pa.

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**Philipe F. Coury*

Central East Region
**Joseph L. Hodges*

Midwest Region
**Chess Pizac*

Rocky Mountain Region
Karl Caldwell

Northeast Region
Frederick W. Monsees

South Central Region
**Will O. Ross*

Southwest Region
M. L. McLaughlin

Great Lakes Region
J. Donald Wohlford

North Central Region
**Edwin W. Rawlings*

Northwest Region
William D. Bozman

Far West Region
William P. Gilson

NATIONAL DIRECTORS

Chairman of the Board—Howard T. Markey, Chicago, Ill.

****John R. Alison** *Hawthorne, Calif.*	***A. Paul Fonda** *Washington, D. C.*	**Carl J. Long** *Pittsburgh, Pa.*	**Roy Sessums** *New Orleans, La.*	**Donald J. Strait** *Bedminster, N. J.*
***Walter T. Bonney** *Silver Spring, Md.*	***Joseph J. Foss** *Sioux Falls, S. D.*	***Harvey J. McKay** *Glendale, Calif.*	****Peter J. Schenk** *Lexington, Mass.*	****Harold C. Stuart** *Tulsa, Okla.*
***Roger J. Browne** *New York, N. Y.*	****John P. Henebry** *Kenilworth, Ill.*	***John B. Montgomery** *Cincinnati, Ohio*	****C. R. Smith** *New York, N. Y.*	****James M. Trail** *Boise, Idaho*
***M. Lee Cordell** *Forest Park, Ill.*	****Robert S. Johnson** *Woodbury, N. Y.*	**O. Donald Olson** *Colorado Springs, Colo.*	**James C. Snapp, Jr.** *San Diego, Calif.*	***Alden A. West** *DeWitt, N. Y.*
****Edward P. Curtis** *Rochester, N. Y.*	****Arthur F. Kelly** *Los Angeles, Calif.*	**Earle E. Partridge** *Colorado Springs, Colo.*	****Carl A. Spaatz** *Chevy Chase, Md.*	****Gill Robb Wilson** *LaVerne, Calif.*
****James H. Doolittle** *Los Angeles, Calif.*	****George C. Kenney** *New York, N. Y.*	**G. Barney Rawlings** *Las Vegas, Nev.*	***William W. Spruance** *Wilmington, Dela.*	***Paul S. Zuckerman** *New York, N. Y.*
	****Thomas G. Lanphier, Jr.** *La Jolla, Calif.*	****Julian B. Rosenthal** *New York, N. Y.*	***Arthur C. Storz** *Omaha, Nebr.*	

***Incumbent** ****Permanent Member**

Fighter Aces Association was organized at Convention. Officers elected, left to right: Col. Jack T. Bradley, First V-P; James L. Brooks, President; Brig. Gen. W. W. Millikan, Sec.-Treas.; Gene Valencia, Second V-P.

Delegates also passed resolutions that:

- Called on Congress to provide "relief and benefits" to survivors of military personnel who lose their lives in the cold war equal to those provided survivors of hot-war fatalities.
- Tendered a "unanimous expression of appreciation" to retiring Joint Chiefs of Staff Chairman Gen. Nathan F. Twining.
- Commended the Federal Aviation Agency for "continuing fulfillment of a difficult mission."
- Pressed Congress and the President to push for development of an operational Mach 3 transport aircraft.
- Commended the staff of AIR FORCE/SPACE DIGEST for "continued dedication and skill in performing their important mission."
- Recommended that DoD and USAF maintain the Aeromedical Transport Service as a permanent USAF activity.
- Called upon the President and Congress to clarify the military mission in space and assign the mission to the Air Force.

A number of other resolutions bearing on the reserve forces are included in the full report on reserve activities at the Convention in this month's "Ready Room" column, which begins on page 115.

In all, it was an outstanding Convention. Some 4,000 registrants, more than ever before, took part. When the Aerospace Panorama was opened to the public on the final day, Sunday, September 25, more than 61,000 San Franciscans came to view the aerospace hardware on display.

Exhibitors, Convention committees of the host San Francisco Squadron of AFA, and sponsors could all share again the satisfaction of a job well done. Committee chairmen, working under Squadron Commander Chas. O. Morgan, Jr., were: Bill Cothran, Vice Chairman, General Committees; Tom Barbour, Vice Chairman, General Committees; Edwin Olsson, Special Activities; Arthur Trost, Arrangements; Charles Davis, Registration; Howard Freeman, Information; Bob Vaughn, Panorama; Don Prator, Promotion; Bill Berman, Transportation; Carl Gamblin, Airports; Clay Bernard, Reception; Thos. F. Stack, Chairman, Civic Affairs; Lawrence Ames, Vice Chairman, Civic Affairs; Mike Kavanaugh, Chairman, Military Affairs; Clifford Griffin, Vice Chairman, Military Affairs.

The Military Host was Maj. Gen. John D. Stevenson. Maj. David B. O'Hara was Air Force coordinating officer.—END

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The Air Force Association is most grateful to the following firms and groups for their contribution to the success of its 1960 National Convention and Airpower Panorama through their sponsorship of the events and activities listed below:

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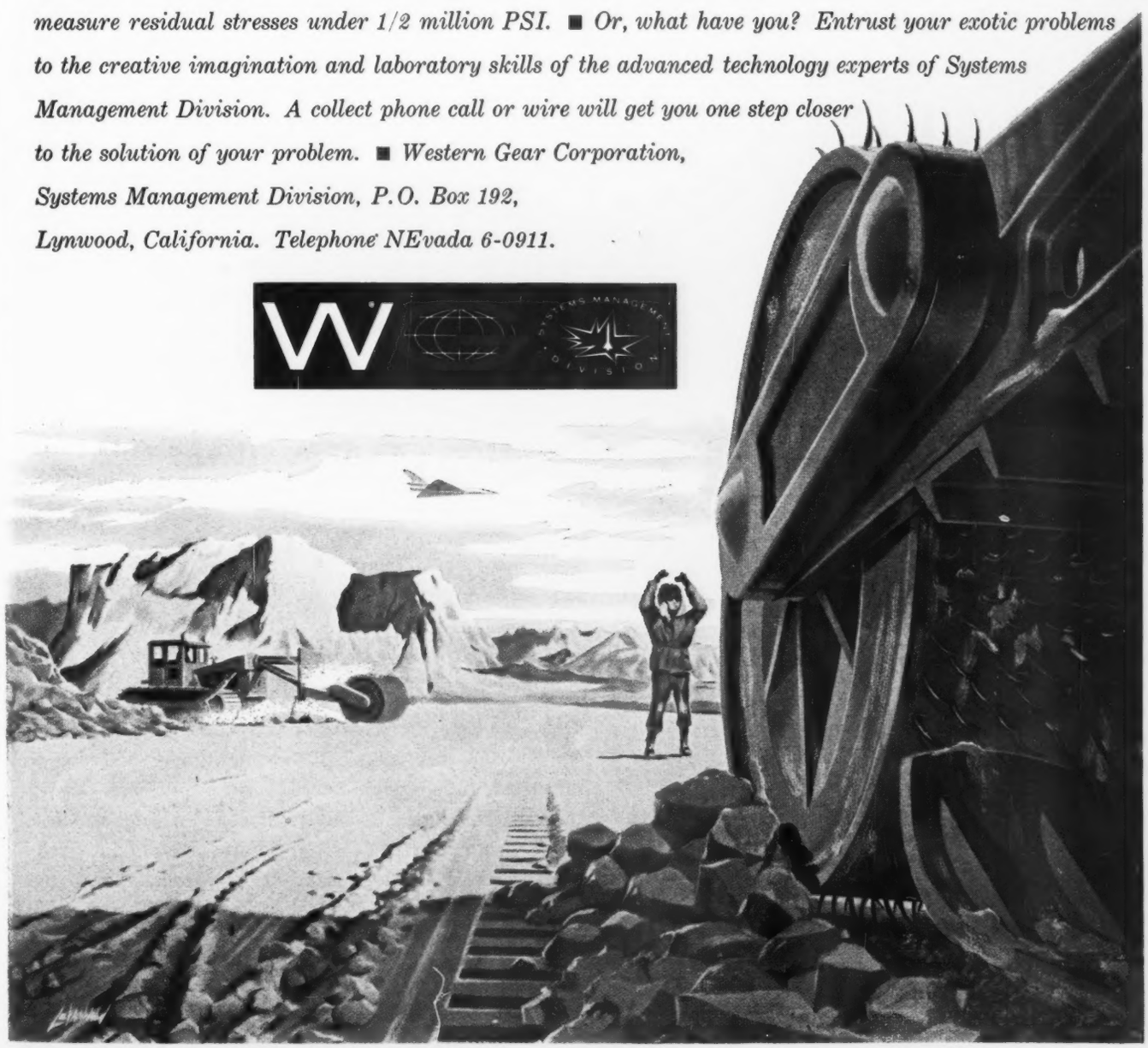

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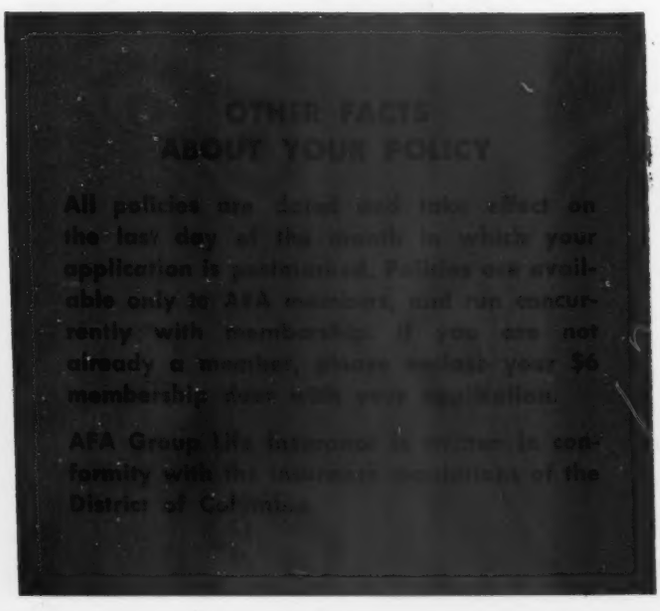

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45-49	12,500	13,500
50-54	10,000	10,000
55-59	10,000	10,000
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*Continuing benefits. Policy must be purchased prior to Age 60.

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AFA NEWS

SQUADRON OF THE MONTH

Pasadena, California, Squadron, Cited for unique and imaginative programing in the public schools, thereby enhancing the relationship between the community and its Air Force.

On October 5, **the Pasadena, Calif., Squadron** sponsored **an educational program** that should go far toward enhancing USAF-community public relations. An **RC-121** of the 552d AEW&C Wing at McClellan AFB, Calif., was flown in to **Van Nuys Airport.** There selected students from nearby schools were given **special briefings** and named **"honorary crew members"** to give them a feel for the work the regular crew undertakes.

At the same time, several USAF aircraft went on static display for the public. A **simulated air battle** was staged, with the honorary crew members sitting beside the regular alert crew in a SAGE unit.

Philip Schwartz, Pasadena Commander, reports the program was successful in all stages. This is not the first time such a program has been sponsored, but it is believed to be **unique to southern California AFA units.** We tip our hats to Pasadena Squadron and its auxiliary, which lent a strong assist, and name this fine unit **AFA's Squadron of the Month.**

* * *

Following the normal number of caucuses in smoke-filled rooms, delegates to the 1960 AFA National Convention selected **twelve new members for AFA's Board of Directors.** Six of these were **National Directors** and six were **Vice Presidents.** National Directors include **Carl J. Long,** Pittsburgh, Pa.; **O. Donald Olson** and **Earle E. Partridge,** Colorado Springs, Colo.; **G. Barney Rawlings,** Las Vegas, Nev.; **Roy T. Sessums,** New Orleans, La.; **Donald J. Strait,** Bedminster, N. J.

Rawlings and Sessums are the only two not nominated by the nominating committee at its meeting in June. It may be well to furnish a few details on each.

Rawlings is assistant manager of the **Clark County, Nev., Convention Bureau.** He was a spark plug in arranging the **first World Congress of Flight** in 1959. It is assumed that he will take at least as active a role in the **1962 World Congress** and **AFA National Convention and Aerospace Panorama,** to be held in his city in September of that year.

Sessums has just finished his second term as **Chairman of AFA's Air Reserve Council.** Prior to that he served for a year as **Vice President for AFA's South Central Region.** He is a Vice President of the **Freeport Sulphur Company,** New Orleans.

Six new Vice Presidents were selected by the delegates from their respective Regions. They were **M. L. "Bo" McLaughlin,** Dallas, Tex., South-

(Continued on following page)

Olmsted, Pa., Squadron Commander H. Joseph Hepford, second from right above, presents AFA Life Membership card to Col. Ralph A. Johnson, an outstanding member of Olmsted Squadron. Others in photograph are Maj. Gen. D. L. Hardy, Association Treasurer Jack Gross, Pennsylvania Wing Commander Steve Yednock.

Iowa Wing Commander Howard Reppert, center, presents Charter to newest Squadron in Iowa Wing, Cedar Rapids. Accepting for the Squadron is Darlowe Oleson, Commander of Cedar Rapids AFAers. All members of the newly formed Squadron are Civil Air Patrol personnel. The Squadron, chartered in September, joins three existing in Wing.

Members of Chico, Calif., Squadron pause for snapshot before leaving for National Convention last month in San Francisco. The Squadron received AFA Exceptional Service Plaque for services to the Association and free world aerospace power during the past year. Second from left in photo is Tom Mason, Commander of the Chico Squadron.

New Little Rock, Ark., Squadron officers. Seated, Commander Willard Hawkins. Standing are Howard Shepherd and L. O. Savage, Vice Commanders, Councilman Frank A. Bailey.

Chicago Association members hosted three area Air Force Academy Cadets at dinner in September. Cadets stand at center above, surrounded by AFAers. At far left, standing, is Illinois Wing Commander Bill Mathieson. Seated in second place from right is National Director Lee Cordell. AFA Squadrons in many parts of the country have honored Academy Cadets in variety of ways.

Right, outgoing Association President Howard T. Markey, AFA Man of the Year O. Donald Olson admire Man of the Year Trophy. Colorado Springs AFAer Don Olson received award at San Francisco Convention for numerous activities.

From Anchorage, Alaska, comes picture of Mr. and Mrs. Gill Robb Wilson as they were being interviewed on television program there. Former Association President, National Director and wife were guests of Anchorage Squadron for a week earlier this year. Mr. Wilson is also publisher of *Flying* magazine.

west Region; **William P. Gilson,** Sacramento, Calif., Far West Region; **Frederick W. Monsees,** Lynbrook, N. Y., Northeast Region; **William D. Bozman,** Boise, Idaho, Northwest Region; **Karl Caldwell,** Ogden, Utah, Rocky Mountain Region; and **J. Donald Wohlford,** Akron, Ohio, for the Great Lakes Region. Two AFA Regions, **Southeast and Pacific Ocean,** were not represented at the Convention by voting delegations. These positions were accordingly declared vacant.

* * *

Chicago's **West Suburban Squadron** recently accepted then-President **Howard Markey's** invitation to sponsor **Cadet Memberships for USAF Academy Cadets** from its area. The Squadron followed up on the program in September by hosting three of the Cadets at a special dinner party. **Bill Grieve,** Squadron Commander, was in charge of the arrangements. He advises us the program was entirely successful. **Lee Cordell,** National Director, was an honored guest of the Squadron (*see cut*).

* * *

CROSS COUNTRY. . . . Las Vegas looked like an outpost of the 1960 Convention, with a great many AFAers stopping over on their way back East. **Bob Gerlach and Gary Ortmann,** from Milwaukee, were two of the many we saw there. They were driving through, complete with Wisconsin cheese, on their way to Mexico. . . . **Tom Stack,** newly elected AFA President, reports that the stork paid its **long-awaited visit** to his family on Wednesday, September 28, right after the Convention. The gift this time was a girl. Tom advises that Penny and his new daughter are both doing just fine, thank you.

It wasn't announced at the Convention due to lack of time, but the **Riverside, Calif., Squadron** applied for a Charter with a **record number of signatures**—339—and was presented the Charter at a meeting October 8. The old record was **Tucson, Ariz.,** with **333.** . . . We just received word, by the way, that the **AFROTC Detachment at the University of Arizona** in Tucson wants to charter a **separate Cadet AFA Squadron** in order to work better with the Tucson Squadron. **Fourteen hundred AFROTC Cadets** are enrolled in the Detachment there.

AFA units in **Arizona, California, and Nevada** are cementing plans to hold the first large-scale regional conference in **Las Vegas** April 7-9, 1961. **Barney Rawlings** has been named chairman. He says he will announce details in a few weeks. . . . The **Duke City Squadron** has been formed in **Albuquerque.** Commander **Warren Fackenthall** invites all area AFAers to take part.—GUS DUDA

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USAF ON FILM

Recent USAF film releases of special interest to readers of AIR FORCE

These and other selected USAF films are available for loan from the Air Force Film Library Center, 8900 S. Broadway, St. Louis 25, Mo. Requests, which are welcome from both military and civilian groups, should contain Air Force serial numbers and correct titles to avoid delay in processing. Because of heavy demands for certain films, particularly those on missiles and space, the Film Library Center recommends that requests indicate both alternate films as well as showing dates.

SFP 587 — Maintainability: Design for Living—How our manned and unmanned weapon systems must be designed for maintenance as well as high performance.

SFP 564—Career Opportunities in ARDC—A tour of ARDC centers where dedicated military and civilian scientists, engineers, and technicians work to conquer time.

SFP 595—Road to the Stars—The story of man's efforts to explore the heavens; history of the rocket and its uses. Vividly portrays military significance of the rocket and its role in preservation of American freedom.

SFP 619—Arctic Airlift—Depicts arduous training necessary to keep Military Air Transport Service planes and crews geared to their wartime airlift mission in support of SAC activities in the Arctic.

SFP 660—The Widest Horizon—Past, present, and future problems confronting man in space; interviews with experts on space problems, ideas, plans.

SFP 657—Intercept—Dealing primarily with computer phase of the SAGE-Bomarc air defense program, film reviews highlight of project from initial planning to successful integration of Bomarc into SAGE system.

SFP 1016—Celestial Mechanics and the Lunar Probe—Employs animation to explain complex arrangement of our solar system and points out important factors to be considered in computing a lunar probe.

SFP 669—Logistic Support Management for Advanced Weapons — The mission of a ballistic missile squadron and components which make up the weapon system; how logistic support management provides prompt and accurate data and the vital part played by Electronic Data Processing Centers.

SFP 1030—Operation Quick Span—The story of "Operation Quick Span" and the TAC Friendship Force which conducts ground displays and aerial demonstrations at selected Central Treaty Organization cities and airfields. CENTO members are Turkey, Iran, Pakistan, Great Britain. The US actively supports CENTO.

SFP 1008—Space Feeding: Beyond the Gravisphere—Review of nutritional principles and problems of feeding man in space.

TF 1-5192a—Be Water Wise: Swimming—How to enjoy safe swimming activities in the pool, at the beach, at the lake, or at the ol' swimming hole.

TF 1-5187—Flight Line Security—Demonstrates how crew chief and aircraft maintenance crew exercise their responsibility in maintaining security on the flight line; also shows how Air Police ensure security on the flight line during nonworking hours.

SFP 681—Aerospace Technical Intelligence Center—ATIC personnel at work at the Aerospace Technical Intelligence Center, Wright-Patterson AFB, Ohio, an integral part of USAF Air Intelligence.

TF 1-5258—The Forward Air Controller—Introducing the forward air controller, who reports to Tactical Air Force Commander and contacts pilots to direct and control USAF aircraft in close proximity to friendly ground forces; maintains advance identification of enemy positions and weapons systems; knows aircraft, ordnance, weapon delivery systems; is an expert on sure, safe, accurate delivery of airborne troops and firepower.

TF 1-5332 — Effective Briefing—Demonstrates and teaches how to plan, organize, prepare, rehearse, deliver staff and command briefings.

AFNR 54—Air Force News Review No. 54—Big Slam/Puerto Pine: A Test of MATS; Mirrors Produce High Heat; Musical Ambassadors Tour Far East; Rugby Really Rugged; Thor Boosts Space Shots.

SFP 664—Sky Tigers—Breathtaking aerobatics of the Chinese Air Force jet demonstration team on display.—END

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Yesterday the World

***The Life and Death of the Luftwaffe*, by Werner Baumbach, translated by Frederick Holt (Coward-McCann, Inc., 1960, 224 pp., $3.95)**

Reviewed by Eugene M. Emme

Here is another worthy volume on the German Air Force in World War II.

This is not a new book. It was largely written immediately after the war. At that time, Baumbach and other ranking Luftwaffe officers were enlisted by the US Air Force to compile the historical lessons of the air war as viewed through defeated German eyes. Headed by the Chief Historian of the German Air Force, General von Rohden, this small group prepared fourteen monographs. Baumbach's efforts are now available in English for the first time.

Baumbach was a highly decorated young Stuka dive bomber pilot. He quickly became a favorite of senior officers and circulated behind the scenes of the Luftwaffe high command. Thus, without holding a major command himself, he became a participant in high-level decision-making through a historic period.

Unlike many other former Luftwaffe officers, Baumbach does not strongly blame Hitler, Goering, or the Nazi system for strategic errors which greatly aided the Anglo-American air effort in Europe. Some of the deficiencies of the Luftwaffe leadership and organization he relates without fully comprehending their consequences. For the most part, he is content to present an airman's view of some of the fundamental turning points of the air war.

Baumbach, who died in Argentine self-exile in 1952, was neither a cautious historian nor a literary craftsman. He wrote subjectively and imprecisely. This volume does, however, provide extremely useful insight into the not-easily-recreated German viewpoint. For the most part, too, Baumbach shows a true grasp of events that decided the outcome of history's greatest air war.

Of especial interest are Baumbach's revelations with reference to a projected four-engine bomber program and a concept set forth in 1942 for aerial refueling—neither of which major projects ever got off the ground.

To this reviewer there seemed to be timeless historical lessons in the areas of weapon system research, development, force structure, and strategy.

About the reviewer: *Dr. Eugene M. Emme is Historian of the National Aeronautics and Space Administration. He is a major in the USAFR, and a former civilian and naval pilot. Dr. Emme edited* The Impact of Air Power, *a major airpower anthology.*

Victory over Japan

In April 1944 bombardier Wilbur Morrison and the crew of the B-29 *King Size*, left Walker Field, Kan., in the first group of Superforts headed for the Far East. A month later *King Size* set down at Piardoba, India. The aircraft began operations against Japanese targets on the Asian mainland and in Japan itself.

Morrison's book *Hellbirds* (Duell, Sloan & Pearce, $3.50) gives a vivid personal account of these first long-range Superfort operations, made all the more interesting because the '29 had been sent into combat before being completely debugged. Malfunctions of many sorts plagued the brave crews of these planes, which also faced swarms of Japanese fighters in their early missions. Their targets in Thailand, Manchuria, Singapore, and on Kyushu—southernmost of the Japanese home islands—lay at the end of flights that taxed human endurance. But the B-29 airmen brought home to the Japanese the meaning of air bombardment and forecast what was in store when the full weight of the air offensive got under way.

Author Morrison describes the great strikes against Japan in terms of a crewman who experienced the bitterness of losing friends in combat, the revulsion of seeing the big silver ships break apart and fall out of formation into oblivion, the uneasiness of being downright scared, and the pride of being a part of this elite fighting corps.

On the other side of the world, with no less skill and determination, Eighth Air Force crews pounded the heart of Nazi Germany in their B-17s and B-24s. On Thursday, October 14, 1943, 291 Flying Fortresses mounted a massive daylight attack on the ball-bearing center of Schweinfurt, Germany. The Nazis were tipped off in advance and waited along the route with ack-ack and swarms of fighters.

The formations flew straight into one of the most savage air battles ever fought in the history of aerial warfare. Disciplined crews kept their aircraft on course, delivered the bombs, and swung around to meet the onslaught again on the flight home. Losses were unbearably high. Sixty Fortresses went down, representing a loss of more than 600 trained airmen.

Black Thursday, by Martin Caidin (Dutton, $4.95), is the graphic detailed account of this mission from its planning through completion. Writing from historic documents, hitherto classified, and personal interviews with mission commanders, flight leaders, and crewmen who survived, Caidin recreates this famous mission in all its violence and heroism.

• • •

An earlier excerpt from air history is chronicled by Paul Gallico. *The Hurricane Story* (Doubleday, $3.95) is a short, highly readable biography of the famous single-seater fighter that played such a major part in winning the Battle of Britain.

Gallico traces the Hurricane from the time in 1933 when RAF officials turned down Sidney Canon's plans for this revolutionary combat fighter. With no backing from the government, Canon built and demonstrated a model at an international air show shortly before the war. The German and Italian observers could not believe their eyes as they watched it outfly and outclimb their first-line aircraft. Fortunately by early 1940 the Hurricane had become a part of RAF hardware.

Going back even farther is William E. Barrett's new Fawcett paperback entitled *The First War Planes* (75¢). Here can be found stories of the great aces of World War I, accounts of aerial combat, descriptions of early scouting planes, fighters, and bombers, of Von Richthofen and the Flying Circus, the Lafayette Escadrille, and the first American squadrons.

• • •

"The first of its kind" best describes the *Air Force Yearbook* (Taylor Publishing Co., 6320 Denton Drive, Dallas, Tex. $6), an excellent photo-narrative of the Air Force past and present. This volume covers the Air Force from its beginnings and brings it up to date. Here is a volume every Air Force family should want to own. Gen. Thomas D. White, USAF Chief of Staff, provides the foreword.

(Continued on page 136)

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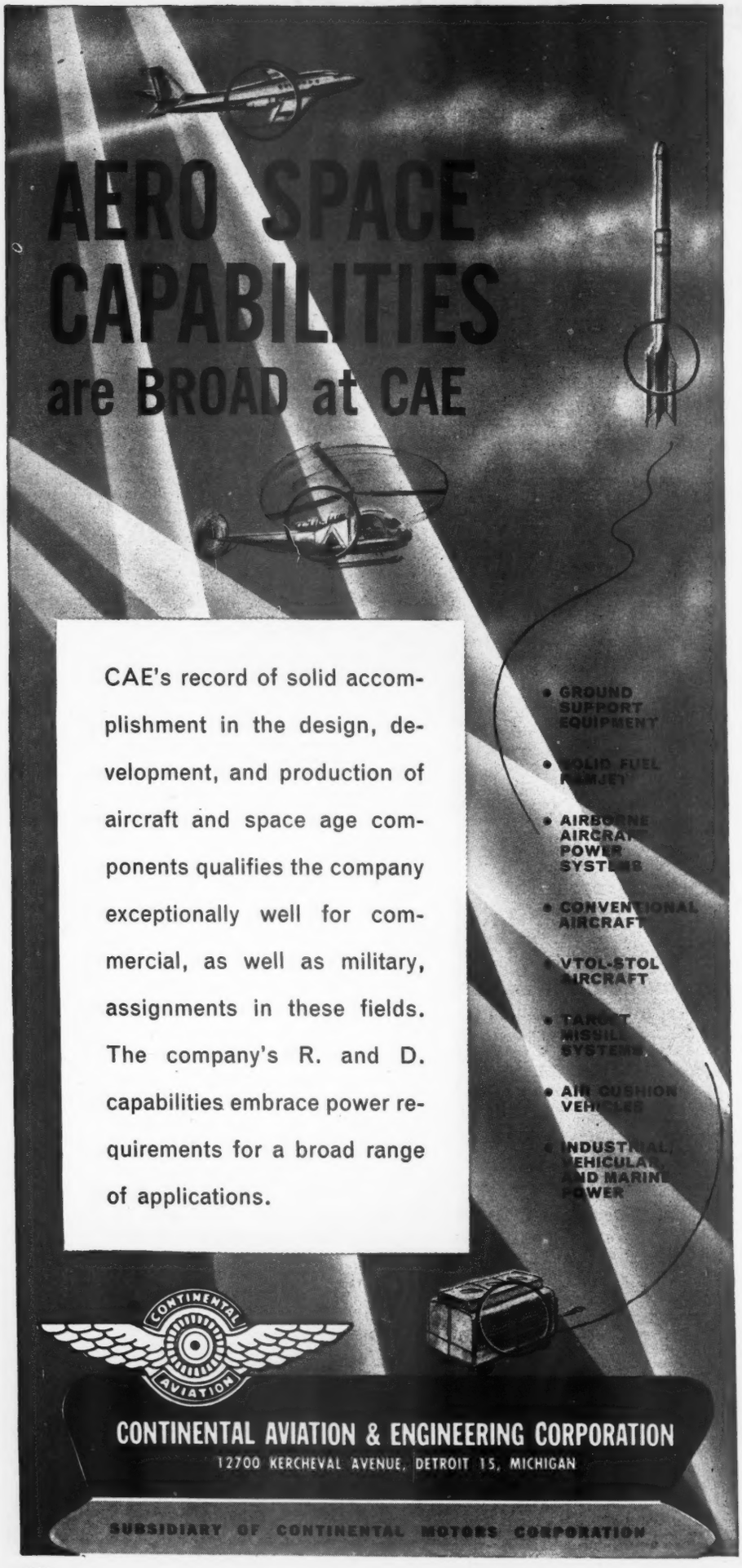
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AIRMAN'S BOOKSHELF

Over Down Under

Now available in the US are two volumes which present a comprehensive history of the Royal Australian Air Force in World War II. *Air War Against Japan, 1943-1945*, by George Odgers, accounts for the RAAF in the Southwest Pacific and in Burma. *Air War Against Germany and Italy, 1939-1943*, by John Nerington, covers Europe and the Mediterranean. Both are thorough and scholarly but also laced with personal experiences of airmen in combat. They were written with the help of captured enemy documents. Published by the Canberra Australian War Memorial in 1957 and 1954, respectively, they are now available through Hampton Books, Hampton Bays, N. Y., for $10 each.

Actually, few people realize the manner in which aviation developed in Australia and the role it played in the growth of that continent and the islands to the north. *The History of Australian Aviation*, by Stanley Brogden (The Hawthorn Press, Melbourne, Australia, $7), is the first full published history of aviation down under. It is also available from Hampton Books, Hampton Bays, N. Y.

° ° °

Technology is giving man his greatest challenge to date in connection with human survival in the environment of space. Indicative of the tremendous effort being made in this area is *Space Biology: The Human Factors in Space Flight*, by two Air Force scholar-historians, Dr. James S. Hanrahan and Dr. David Bushnell (Basic Books, $6). The volume surveys research and development in human factors from the days of early aviation to the present state of the art. Discussed are current programs, the men involved, their accomplishments in experimentation involving physical and mental problems inside space vehicles, G-forces, weightlessness, and radiation hazards.

William J. Weiser's *The Space Guidebook* (Coward-McCann, $4.75) tests the layman's IQ. Chapters are made up of questions and answers on missiles, rockets, spaceflight and human survival, space exploration, the universe, stars, planets.

McGraw Hill's new, comprehensive *International Missile and Spacecraft Guide*, by Frederick I. Ordway III and Ronald C. Wakeford ($25), exceeds by far any comparable encyclopedic reference yet published. It contains a vast collection of technical data and general material on American and foreign rockets, missiles, and

CONTINUED

space vehicles, with more than 850 photos, side views, and drawings chronicling the development of military and research missiles over the past fifty years.

Technical Aerospace

Principles of Mechanics of Solids and Fuels, Vol. I, Particle and Rigid Body Mechanics, by Hsuan Yeh and Joel L. Abrams (McGraw Hill, $8.95).

Advances in Space Science, Vol. II, edited by Fred I. Ordway III (Academic Press, $13). Seven essays by specialists survey principles of construction and performance of contemporary rocket engines.

History of German Guided Missiles Development, edited by T. H. Benecke and A. W. Quick (Verlag E. Appelhaus, Germany, $7.50).

Basic Gyroscopes, by Carl Machover, 2 Vols (Rider, $3.30 each).

Economic Atlas of the Soviet Union, by George Kish (Univ. of Michigan Press, $10). Maps and text in five general sections: physical features, vegetation, administration, air transport, population distribution.

Airport Concrete Pavement Handbook, (Wire Reinforcement Institute, free upon organizational request, $3.00 otherwise). Descriptive information, data, tables and design criteria for design of reinforced portland cement concrete pavement for airports handling all types of planes, including jets.

Theory of Inertial Guidance, by Connie L. McClure (Prentice-Hall, $9).

Physics of the Upper Atmosphere, edited by J. A. Ratcliffe (Academic Press, $14.50).

An Introduction to the Theory of Aircraft Structures, by D. Williams (St. Martin's Press, $15). Highly technical.

Moon Maps, by H. L. Wilkins (Macmillan, $6). Detailed charts of the moon suitable for use at the telescope, scaled 55.4 miles to the inch, and including the "other side" based on Russian photographs.

Fundamentals of Rocket Propulsion, by Raymond E. Wiech and Robbert F. Strauss (Reinhold, $5.50). All-inclusive review of the rocket engine, its history, operation, design, and application, for guidance and electronic engineers, propellant chemists, chemical and mechanical engineers, metallurgists, and students. Part of Reinhold Space Technology Series.

Theory of Flight, by Richard Von Mises (Dover, $2.85). Aerodynamics and aircraft.

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The Big Show by Pierre Clostermann (Ballantine, 50¢)—Reissue of this fighter pilot's day-by-day story of 400 aerial engagements against the Luftwaffe in World War II.

Stars in the Making by Cecilia Payne-Gaposchkin (Pocketbooks, 50¢)—The evolution of the universe, its present state, and the future toward which it is moving, by a Harvard astronomer.

Science Year: A Survey of the Year's Science and Technology, by John L. Russell, Jr. (Popular Mechanics Press, $1)—A highly illustrated picture account with emphasis on rockets, missiles, astronautics. Contains rundown on all major USAF missiles.

—MAJ. JAMES F. SUNDERMAN, USAF

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